VOLUME 12 NUMBER 6 / MARCH 23, 1974

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbomachinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N74-14701 Engineering Sciences Data Unit, London (England).
PROFILE DRAG AT THE DRAGE-RISE CONDITION OF AEROFOILS HAVING A SPECIFIED FORM OF UPPER-SURFACE PRESSURE DISTRIBUTION AT THIS CONDITION
Oct. 1973 5 p refs
(ESDU-67011) Copyright. Avail: Issuing Activity

The development of airfoils based on an inviscid flow theory incorporating a description of compressibility effects is discussed. An inversion of the method has led to the derivation of a new family of airfoils in which boundary layer displacement effects and the use of compressibility factors are significant. A method for obtaining the profile drag of the airfoils is reported. The drag coefficient increments for the redesigned airfoils are plotted in graph form. The drag coefficient increments for the upper surface, lower surface, and total, for fully attached flow are presented. Author

N74-14702*+ National Aeronautics and Space Administration, Washington, D.C.
AERONAUTICAL ENGINEERNG: A SPECIAL BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 36
Oct. 1973 184 p refs
(NASA-SP-7037(36)) Avail: NTIS HC $5.25 CSCL 01A

This special bibliography lists 628 reports, articles, and other documents introduced into the NASA scientific and technical information system in September 1973. Author

N74-14703 California Inst. of Tech., Pasadena.
TURBULENT MIXING LAYER EXPERIMENT IN SUPERSONIC FLOW Ph.D. Thesis
Hideo Ikaea 1973 229 p
Avail: Univ. Microfilms Order No. 73-26466

A supersonic, two-dimensional, turbulent free mixing layer was experimentally investigated in the GALCIT supersonic wind tunnel to clarify the Mach number dependence of this flow field. The tests were conducted with a nominal Mach number of 2.47 with an ambient stagnation condition. Self similarities of the mean and turbulent flow fields were established. The mean and fluctuating flow measurements were made. In addition, the actual entrainment rate of the turbulent free mixing layer through the low speed interface was also measured and it was verified that this quantity equals the growth rate of momentum thickness. The spreading rate, the entrainment rate, and the maximum shear stress were appreciably smaller than the respective incompressible values. Maximum streamwise velocity fluctuation was approximately 1/3 of the incompressible value. The flow field of turbulent free mixing layer was found to be highly dependent upon the supersonic compressibility effect. Dissert. Abstr.

N74-14704 Ohio State Univ., Columbus.
THE EFFECTS OF HYPERSONIC VISCOUS INTERACTION ON STATIC STABILITY OF SLENDER BODIES IN SIMULATED NON-EQUILIBRIUM FLOWS Ph.D. Thesis
Robert William Betts 1973 103 p
Avail: Univ. Microfilms Order No. 73-26772

One phase of a similitude study of slender bodies in low density nonequilibrium flow is reported. Force and moment coefficients were obtained for a 10 degree half-angle cone at hypersonic, low density conditions for which viscous interaction is important. Measurements were made over an angle of attack from 0 to 10 degrees. By the introduction of selected amounts of argon to air it was possible to simulate the range of specific heat ratio variation from 0 to 100 percent oxygen dissociation in air. Both Newtonian theory and a modified version of tanget cone theory (MTC) were used to define the similitude parameters applicable to both free flight and wind tunnel data.
Dissert. Abstr.

N74-14705 Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
FORCE MEASUREMENTS ON CARET AND DELTA WINGS OVER THE INCIDENCE RANGE 27 DEG LESS THAN OR EQUAL TO ALPHA LESS THAN OR EQUAL TO 55 DEG AT M 12.2
C. J. Carr Oct. 1971 11 p refs
(IC-Aero-71-22)

A series of tests measuring and comparing the forces on a flat bottom delta wing and a caret wing performed at M 12.2 over the incidence range 27 deg to 55 deg. The wings were of identical planform and thickness. The caret wing exhibited higher values of normal force, lift, and drag coefficients than the flat delta for any given incidence within the range tested. ESRO

N74-14706 Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
THE FLOW FIELD AND PRESSURE DISTRIBUTION OF AN ISOLATED ROAD WHEEL
J. E. Fackrell and J. K. Harvey 1972 11 p refs Sponsored partly by Sci. Res. Council and Dunlop Tyre Co.
(IC-Aero-72-14)

The air flow around two wheel profiles typical of those used on racing cars was studied. The flow around a stationary wheel is compared with that around the same wheel when rotating in order to highlight the specific effects of rotation. Lift and drag are calculated from pressure distributions over the wheels. The distributions themselves reveal useful information on the flow field. Total head measurements of the flow around the wheel and some special features are discussed. Author (ESRO)

N74-14707*# Princeton Univ., N.J. Dept. of Aerospace and Mechanical Sciences.
[FLUTTER COMPUTER PROGRAM AND LIFTING SURFACE THEORY WITH BOUNDARY LAYER] Semiannual Progress Report, 1 Apr. - 1 Oct. 1973

Earl H. Dowell and C. Samuel Ventres 1 Oct. 1973 7 p refs (Grant NGR-31-001-197)
(NASA-CR-136559) Avail: NTIS CSCL 01A

A flutter program has been developed for a rectangular, orthotropic panel on point supports of finite stiffness as well as edge, line supports of finite stiffness. To check the flutter program, per se, simple piston theory aerodynamics were used. Lifting surface theory with boundary layer was used to solve the incompressible, steady, two dimensional flow problem. Author

N74-14708# National Research Council of Canada, Ottawa (Ontario).
AN EXPERIMENTAL ANALYSIS AND BUFFET INVESTIGATION OF THE SHOCKLESS LIFTING AIRFOIL NO. 1
J. J. Kacprzynski Aug. 1973 52 p refs
(NRC-13673; LR-569) Avail: NTIS HC $4.75

Wind tunnel tests to determine the aerodynamic characteristics of a shockless lifting airfoil were conducted. The improvements to the wind tunnel which led to conducting the tests are described. The experiments were performed with 20.5 percent porosity of the top and bottom walls of the test section. The aerodynamic coefficients obtained from integration of the pressure distribution and from the balance and wake drag measurements are listed. Buffet characteristics were investigated at Mach numbers of 0.51, 0.621, 0.7, and 0.768. The buffet boundaries determined from oscillations of the normal force component correspond well with the pressure divergence observed. Author

N74-14709# Advisory Group for Aerospace Research and Development, Paris (France).
AERODYNAMIC DRAG
Oct. 1973 469 p refs Partly in ENGLISH and partly in FRENCH Proc. of the Fluid Dyn. Panel Specialists Meeting, Izmir, Turkey, 10-13 Apr. 1973
(AGARD-CP-124) Avail: NTIS HC $25.50

The proceedings of a conference on aerodynamic drag are presented. Current research and future prospects in the field of aerodynamic drag are considered. Main emphasis was placed on subjects of practical value to the aerospace industry in relation to the need for accurate prediction, measurement, and alleviation of drag. Some of the subjects considered are: (1) aircraft drag, (2) wing drag, (3) base drag and separation, (4) interaction effects, (5) hypersonic drag, and (6) testing techniques and correlation of flight test and wind tunnel test data. For individual titles, see N74-14710 through N74-14738.

N74-14710 Ministry of Defence, London (England).
TECHNICAL EVALUATION REPORT
S. F. J. Butler *In* AGARD Aerodyn. Drag Oct. 1973 11 p (For availability see N74-14709 06-01)

A primary objective of research on aerodynamic drag is the development and proving of prediction methods in a form suitable for direct use by aircraft development teams and by those who have to assess the relative merits of alternative designs. Aircraft drag estimation methods are needed at various levels of sophistication and reliability. Basic statistical analyses can form the basis of an acceptable forecasting procedure at the feasibility stage, although such an approach is essentially conservative and can lead to the perpetuation of low design standards, as well as being of little use when novel aircraft design concepts are under consideration. Of some significance is the ability to predict reliably the drag of a datum streamlined aircraft with fully-turbulent flow, against which achieved drag levels can be compared in a figure-of-merit approach. During the design development and refinement stage, the research aims include the achievement of drag design objectives and the limitation of drag growth. In this phase, drag predictions in practice must be prepared by a process of synthesis (rather than simple summation), within a format which can readily accommodate the changing sources of data. Author

N74-14711 Lockheed-Georgia Co., Marietta.
A SURVEY OF DRAG PREDICTION TECHNIQUES APPLICABLE TO SUBSONIC AND TRANSONIC AIRCRAFT DESIGN
J. H. Patterson, D. G. MacWilkinson, and W. T. Blackerby *In* AGARD Aerodyn. Drag Oct. 1973 38 p refs (For availability see N74-14709 06-01)

The following aspects of aircraft drag prediction in the subsonic to transonic range are discussed: (1) preliminary estimation procedures, (2) estimation using wind tunnel test data, and (3) wind tunnel data and flight test data correlation. Inaccuracies in the approach to the use of flat plate skin friction, with appropriate shape factors, to predict profile drag are identified. Attempts to use low Reynolds number wind tunnel drag levels to predict full scale drag are shown to be reasonably successful. The prediction of C-5A aircraft drag characteristics from wind tunnel tests is discussed. Author

N74-14712 Naval Weapons Lab., Dahlgren, Va.
AERODYNAMIC DRAG AND LIFT OF GENERAL BODY SHAPES AT SUBSONIC, TRANSONIC AND SUPERSONIC MACH NUMBERS
Frankie G. Moore *In* AGARD Aerodyn. Drag Oct. 1973 11 p refs (For availability see N74-14709 06-01)

Several theoretical and empirical methods are combined into a single computer program to predict drag, lift, and center of pressure on bodies of revolution at subsonic, transonic, and supersonic Mach numbers and for angles of attack to twenty degrees. The body geometries can be quite general in that pointed, spherically blunt, or truncated noses are allowed as well as discontinuities along the nose. Particular emphasis is placed on methods which yield accuracies of ninety percent or better for most configurations but yet are computationally fast. To handle the blunt nosed configurations, a new procedure has been employed: that of combining modified Newtonian theory with perturbation theory. Theoretical and experimental results are presented for several projectiles and the comparisons meet the general accuracy requirements above. The combined perturbation - Newtonian theory gave pressures which compared better with experiment than any existing approximate technique in the lower supersonic speed regime. Author

N74-14713 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Aerodynamik.
ON SOME BASIC AND NEW ASPECTS ABOUT THE DRAG PROBLEM OF WINGS AND BODIES IN SUPERSONIC FLOWS
Arabindo Das *In* AGARD Aerodyn. Drag Oct. 1973 26 p refs (For availability see N74-14709 06-01)

With the objective to determine optimum shapes of slender wings and bodies for minimum total drag in supersonic flows a comprehensive theoretical and experimental analysis of the problem has been carried out. The theoretical formulas for the various drag components which are necessary for a variational problem of drag minimization have been reviewed, summarized, partly modified or extended, and finally compared with experimental values. Based on the linearized mass flux concept already known in the literature a modified boundary condition leads to a certain improvement in the results of the linear theory. A simplified treatment of the modified linear theory is presented. A unified approach to the problem of minimization of wave drag due to volume and wave drag due to lift yields very simple analytical results. The optimum body shapes show a certain dependence on Mach number. For minimization of vortex drag the necessary wing twist yields a remarkable improvement, which could also be verified by experiment. While the known friction drag formulas from the literature have been checked with experimental values, the problem of base drag of axial symmetrical bodies has not been completely solved as yet; theoretical work on this topic is being continued. Author

N74-14714 Royal Aircraft Establishment, Bedford (England).
MEASUREMENTS OF THE DRAG OF SOME CHARACTERISTIC AIRCRAFT EXCRESCENCES IMMERSED IN TURBULENT BOUNDARY LAYERS
L. Gaudet and K. G. Winter *In* AGARD Aerodyn. Drag Oct. 1973 12 p refs (For availability see N74-14709 06-01)

Measurements are described of the drag of various forms of excrescence mounted on balances installed in the walls of the working section of the RAE 8ft x 8ft wind tunnel. The tests cover a range of Mach numbers between 0.2 and 2.8 (but not transonic) and a range of Reynolds number. The excrescences tested include two-dimensional steps and ridges, circular cylinders and wings mounted normal to the surface, and holes and fairings.

It is shown, for excrescences which are of height small compared with the boundary-layer thickness, that the scale effects on drag are well correlated in terms of the wall variables of the turbulent boundary layer, but that there is a dependence of drag on Mach number. For steps and ridges the effect of chamfering or rounding the upper corners was found to be beneficial at subsonic speeds but far less so at supersonic speeds. For circular holes the drag depends strongly upon the depth to diameter ratio. The fairings tested were either half-bodies of revolution with pointed or rounded ends or of square or rectangular section with pointed ends. The effects of different amounts of immersion of the bodies into the boundary layer was found in some cases by testing geometrically similar bodies of different sizes. Author

N74-14715 Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).

PROBLEMS OF ESTIMATING THE DRAG OF A HELICOPTER

S. N. Wagner *In* AGARD Aerodyn. Drag Oct. 1973 12 p refs (For availability see N74-14709 06-01)

The components which contribute to the drag of a helicopter are identified as: (1) the drag of the main and tail rotors, (2) fuselage drag, (3) pylon drag, (4) landing gear drag, (5) fairing drag, and (6) drag caused by interference between the helicopter components. The difficulties and advantages of methods for defining the drag of a helicopter are analyzed. Procedures for testing small scale models of helicopters are discussed. The correlation of model data with flight test data is examined. Author

N74-14716 Royal Aircraft Establishment, Farnborough (England).

AIRCRAFT DRAG PREDICTION FOR PROJECT APPRAISAL AND PERFORMANCE ESTIMATION

S. F. J. Butler *In* AGARD Aerodyn. Drag Oct. 1973 50 p (For availability see N74-14709 06-01)

The principal stages in aircraft feasibility study and design development are considered, leading to the specification of desirable characteristics of aircraft drag prediction models. The contributions to drag modelling to be expected from research are reviewed, together with the impact of computerized design selection and mission analysis methods. An assessment of the relative importance of different components and sources of drag introduces surveys, which examine the present state of the art of prediction for specific classes of aircraft and for particular aspects of drag. The main problems involved in executing and analysing model and aircraft tests are also discussed in the drag context. The collection, analysis and dissemination of data suitable for direct use in practical design methods are discussed. Author

N74-14717 Engineering Sciences Data Unit, London (England).

APPENDIX: A DATA ITEM SERVICE FOR AIRCRAFT DRAG ESTIMATION

In AGARD Aerodyn. Drag Oct. 1973 9 p refs (For availability see N74-14709 06-01)
Avail: NTIS

The terms of reference for an engineering unit concerned with determining aerodynamic drag are discussed. The functions of the organization are defined: (1) to collect and disseminate information on drag prediction for sweptwing aircraft, (2) to arrange for the correlation and analysis of relevant data, (3) to formulate a comprehensive framework for the analysis and synthesis of aircraft drag, and (4) to encourage the introduction and adoption of improved drag prediction methods. Author

N74-14718 Douglas Aircraft Co., Inc., Long Beach, Calif.

REMARKS ON METHODS FOR PREDICTING VISCOUS DRAG

A. M. O. Smith and Tuncer Cebeci *In* AGARD Aerodyn. Drag Oct. 1973 12 p refs (For availability see N74-14709 06-01)

While predictions of low speed profile drag are accurate for monoelement airfoils at low angle of attack, the methods are not very accurate at higher angles of attack, or for multielement airfoils or for fatter bodies of revolution. Two courses that might lead to possible improvement in accuracy have been investigated. One was an attempt to perform direct shear and pressure stress calculations on an airfoil or body. The other was an attempt to improve the Squire-Young momentum defect method by actually solving the wake for a short distance. The first method was not successful but the second method shows promise. Hence, it is tentatively concluded that refinement of the momentum defect method is the most promising path towards improved accuracy. Author

N74-14719 National Aeronautical Establishment, Ottawa (Ontario).

DRAG OF SUPERCRITICAL AIRFOILS IN TRANSONIC FLOW

J. J. Kacprzynski *In* AGARD Aerodyn. Drag Oct. 1973 20 p refs (For availability see N74-14709 06-01)

Analytical methods of evaluation of drag coefficients of contemporary supercritical airfoils are discussed. Some results of experimental values of drag coefficient for supercritical airfoils are compared against results of theoretical evaluations. Some results of drag coefficients of conventional airfoils are included for comparison. Difficulties of accurate experimental recording of drag coefficients are indicated. Author

N74-14720 General Dynamics/Convair, San Diego, Calif. Aerospace Div.

TRANSONIC DRAG DUE TO LIFT OF PLANAR JET-FLAPPED AIRFOILS

H. Yoshihara, R. Magnus, and D. Zonars (AFFDL) *In* AGARD Aerodyn. Drag Oct. 1973 8 p refs (For availability see N74-14709 06-01)

In contrast to the low speed case test results indicate that lift augmentation by the jet flap in the transonic regime is accompanied, not by a large thrust recovery, but by a significant increase in drag. However to achieve moderate to high lifts the use of jet flaps rather than incidence has led to a significant reduction in the drag due to lift. To calculate the transonic jet flap flow a modified Spence jet flap condition is postulated and incorporated into the (unsteady) finite difference procedure. An example is then calculated and compared with experimental results. Author

N74-14721 National Aerospace Lab., Amsterdam (Netherlands).

COMPARISON OF VARIOUS METHODS FOR CALCULATING PROFILE DRAG FROM PRESSURE MEASUREMENTS IN THE NEAR WAKE AT SUBCRITICAL SPEEDS

J. Zwaaneveld *In* AGARD Aerodyn. Drag Oct. 1973 12 p refs (For availability see N74-14709 06-01)

Methods for calculating the profile drag from total and static pressure measurements in aircraft wake have been compared. An analytical model of a compressible two-dimensional wake is used to obtain numerical results. Both the oldest method of Betz and the widely used method of Jones allow the static pressure variation across the wake to be taken into account. These methods are therefore suitable to treat the flow in the very near wake. The third method developed by Squire and Young is in principle only valid when the static pressure variation across the wake is negligible. To extend this method to the more general case, two modifications are considered, the first as proposed by Squire and Young, the second as presented by the author. The latter modification makes use of the momentum integral equation with modified parameters. The numerical results show this new approach to be in far better agreement with the method of Jones than the first mentioned modified version. Author

N74-14722 Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

DRAG AND SEPARATION

Maurice Sirieix *In* AGARD Aerodyn. Drag Oct. 1973 23 p refs In FRENCH; ENGLISH summary (For availability see N74-14709 06-01)

The unsteady character of some separated flows and their resulting effects are discussed. The different types of turbulent separated flows of a limited extent and quasi-steady character are defined. The expected effects of these separated flows on the aerodynamic drag were studied. Theoretical methods of prediction are explained. Examples in which separated flows appear are analyzed. Author

N74-14723 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).
NEW INVESTIGATIONS FOR REDUCING THE BASE DRAG OF WINGS WITH A BLUNT TRAILING EDGE
Mauri Tanner *In* AGARD Aerodyn. Drag Oct. 1973 9 p refs (For availability see N74-14709 06-01)

Investigations were conducted to determine methods for reducing the base drag of wings with blunt trailing edges. Measurements were performed on a rectangular wing in a low speed wind tunnel. The wing was fitted with broken trailing edges, splitter plates, and splitter wedges. The tests showed that the base drag could be substantially reduced by fitting a splitter wedge on the trailing edge. For the most advantageous splitter wedge, the base drag was nearly zero. In this case the maximum lift to drag ratio for the wing with a blunt trailing edge was as great as that for the corresponding wing with a conventional sharp trailing edge. Author

N74-14724 Illinois Univ., Urbana. Dept. of Mechanical and Industrial Engineering.
A STUDY OF FLOW SEPARATION IN THE BASE REGION AND ITS EFFECTS DURING POWERED FLIGHT
A. L. Addy, H. H. Korst, R. A. White, and B. J. Walker (Army Missile Command, Redstone Arsenal, Ala.) *In* AGARD Aerodyn. Drag Oct. 1973 15 p refs (For availability see N74-14709 06-01)

The effect of the separated flow region on the performance of aircraft and missiles during powered flight is discussed. The interaction between the propulsive jet and the free stream flows is emphasized. The Chapman-Korst component flow model allows the qualitative and quantitative discussion of the effects of the afterbody-base problem of all pertinent design and performance parameters. The usefulness of the component approach has been enhanced by semi-empirical modifications, improvements of individual components, and the development of computer programs. It is shown that the onset and location of plume-induced separation of the external flow can be predicted given a suitable boundary layer separation criterion. Author

N74-14725 LTV Aerospace Corp., Dallas, Tex.
PREDICTION OF BUFFET ON-SET FOR AIRCRAFT, RECENT PROGRESS IN WIND TUNNEL AND FLIGHT TEST DATA CORRELATION
R. C. McWherter *In* AGARD Aerodyn. Drag Oct. 1973 8 p refs (For availability see N74-14709 06-01)

Methods for predicting and determining the onset of buffet during aircraft flight are analyzed. The buffet characteristics of F-4 amd F-8 aircraft are reported. Diagnostic data on wind tunnel flow is examined to determine the property or properties which are necessary to obtain repeatable, sensible buffet onset predictions from model testing. The characteristics of wind tunnels which affect the results of buffet investigations are examined. Author

N74-14726 Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
ASSESSMENT OF THE INFLUENCE OF INLET AND AFTBODY/NOZZLE PERFORMANCE ON TOTAL AIRCRAFT DRAG
Philip P. Antonatos, Lewis E. Surber, James A. Laughrey, and Donald J. Stava *In* AGARD Aerodyn. Drag Oct. 1973 28 p refs (For availability see N74-14709 06-01)

The influence of propulsion system installation on aircraft drag is discussed. Using information from several investigations, different aspects of airframe propulsion integration are explored, each of which affects the assessment of aircraft drag. A great deal of apparently conflicting data has been generated on airframe-propulsion integration simply because the investigators concerned with different aspects of a system development have not properly integrated their own efforts to assure that theoretical analysis methods are consistent with wind tunnel test methods, that the test models are consistent with each other, and that adequate corrections for the effect of model mounting systems can be made. Even rather small inconsistencies in just a few of these considerations may result in errors of sufficient magnitude to affect aircraft design decisions adversely. A major part of the difficulty of making an accurate assessment of inlet/aftbody nozzle effect on aircraft drag is the prediction of flight performance from wind tunnel test data. Early system development should be studied carefully to assure that the program of airframe-propulsion integration and the demands on propulsion related drag assessment are consistent with drag estimate accuracy for the airframe. Author

N74-14727 Boeing Commerical Airplane Co., Renton, Wash.
THE PROBLEM OF INSTALLING A MODERN HIGH BYPASS ENGINE ON A TWIN JET TRANSPORT AIRCRAFT c02
Walter C. Swan and Armand Sigalla *In* AGARD Aerodyn. Drag Oct. 1973 12 p (For availability see N74-14709 06-01)

An examination of the engine placement on a modern jet transport presents new drag and stability problems. Large high bypass ratio engines create large annular and wetted area drag and blockage surfaces which can cause difficult configuration problems as well as large interference drag and stability effects. The option is open to conventional underwing and aftbody mounted installations as well as renewed opportunity for over-the-wing installations. In this paper the drag and stability consequences for each class of configuration is examined for a typical intermediate range transport. The results are equally valid for short haul and certain STOL missions. In some instances, it is shown, proper pod shape and positioning may result in favorable drag increments, especially on modern swept wings with supercritical airfoil sections. Side effects such as pod influences on wing flutter, deep stall, and general sizing of the empennage are discussed. Author

N74-14728 National Aeronautical Establishment, Ottawa (Ontario).
THE DRAG RESULTING FROM THREE-DIMENSIONAL SEPARATIONS CAUSED BY BOUNDARY-LAYER DIVERTERS AND NACELLES IN SUBSONIC AND SUPERSONIC FLOW
David J. Peake and William J. Rainbird (Carleton Univ.) *In* AGARD Aerodyn. Drag Oct. 1973 22 p refs (For availability see N74-14709 06-01)

Three-dimensional viscous flow separations and their effect on configuration drag are examined in high Reynolds number tests conducted in the NAE 5-ft x 5-ft blowdown wind tunnel in both subsonic and supersonic flow. In particular, emphasis is placed on the geometry of the system to divert the oncoming boundary layer about propulsion nacelles. To avoid significant three-dimensional separations, avoid imposing large adverse streamwise pressure gradients upon an oncoming boundary layer, such as those produced near stagnation point regions of bluff diverters, or adjacent to intakes operating below design mass flow. The avoidance of these strong streamwise pressure gradients is seen to be readily achieved by increasing the diverter slenderness ratio and by keeping intakes operating at design conditions by means of auxiliary by-pass arrangements. Author

N74-14729 Royal Aircraft Establishment, Bedford (England).
THE DRAG OF EXTERNALLY CARRIED STORES: ITS PREDICTION AND ALLEVIATION
P. G. Pugh and P. G. Hutton *In* AGARD Aerodyn. Drag Oct. 1973 11 p refs (For availability see N74-14709 06-01)

The installed drag of stores makes a major contribution to the total drag of combat aircraft. It can be several times the sum of the free-air drags of the individual stores and its prediction and reduction are essential to the design of high-performance aircraft. Interference effects involved range from simple buoyancy to complex interactions involving viscous and wave drag phenomena. For the simpler cases there are good prospects that the installed drag can be accurately predicted either by current methods or by relatively straightforward extensions of these. However, empirical methods will continue to be needed for the prediction of the drag of complicated cases eg. multiple store arrays at transonic speeds. Some examples are given to show the opportunities for reducing the installed drag either by redesigns to take advantage of improved mechanical systems or through the development of radically new installations. Author

N74-14730 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).
DRAG IN HYPERSONIC RAREFIED FLOW
Walter Wuest *In* AGARD Aerodyn. Drag Oct. 1973 12 p refs (For availability see N74-14709 06-01)

The drag force in hypersonic flow may be divided into cold pressure drag (incident molecules), temperature depending pressure drag (diffusively reflected molecules) and friction drag. The pressure drag dominates on blunt bodies which show a slighter drag variation with rarefaction whereas on slender bodies friction drag dominates and the total drag is strongly influenced by rarefaction. Relaxation and radiation do not appreciably alter the pressure drag but influence the flow field, stand-off distance of shock wave, and heat transfer. Author

N74-14731 Centre National de la Recherche Scientifique, Meudon (France). Lab. d'Aerothermique.

DRAG OF LIFTING BODIES FOR PILOTS AT HIGH ALTITUDE [TRAINEE DE CORPS PORTANTS PILOTES A HAUTE ALTITUDE]

J. Allegre, C. Matrand, and M. F. Scibilia *In* AGARD Aerodyn. Drag Oct. 1973 10 p refs In FRENCH; ENGLISH summary (For availability see N74-14709 06-01)

Lifting bodies with 60 deg swept delta wings fitted out with control devices, located near the trailing edge of the wings are analyzed. The present experimental study of the aerodynamic behaviour of the wing is realized in a rarefied flow simulating a flight altitude of about 70 km. Experiments are performed in an open jet and continuously operating wind tunnel. The air flow is characterized by a Mach number of 8.1 and a free stream Reynolds number of 2200 per cm. Results show how much aerodynamic devices associated with the delta wing, like spoilers, remain efficient and can be used in order to control the trajectory at high altitude. Drag coefficient data are given in the range of incidences between minus 20 deg and 20 deg. A comparison between efficiencies of trailing edge solid spoilers and trailing edge fluid spoilers allows to point out some advantages of the fluid spoilers. In particular, this jet control mechanism can create a sufficient side thrust without entailing a large increase of the drag. Author

N74-14732 Aeritalia, Turin (Italy).

A REVIEW OF SUPERSONIC SPHERE DRAG FROM THE CONTINUUM TO THE FREE MOLECULAR FLOW REGIME

E. Vallerani *In* AGARD Aerodyn. Drag Oct. 1973 15 p refs (For availability see N74-14709 06-01)

The evaluation of the sphere drag coefficient has been the object of extensive theoretical investigations for a long time. A large amount of experimental data has been collected to substantiate those studies and to provide the needed information for the flow regimes for which the theoretical approaches are still missing. The scope of the present review is to attempt the establishment of a more complete panorama of the supersonic sphere drag predictions over the entire range of flow regimes ranging from the continuum flow to the free molecular flow, in order to provide in a consistent form the design engineer of the information required for the aerodynamic design of space vehicles. The theoretical methods developed to cover the various flow regimes such as: (1) continuum low density, (2) free molecular, (3) near free molecular, and (4) intermediate have been reviewed and discussed in the light of the comparison with the pertinent experimental data available. New semiempirical formulas for the correlation of the experimental data are derived for the low density continuum flow and for the near free molecule flow regimes. For the intermediate flow regimes, ranging between the continuum flow and the free molecular flow, the results of a semiempirical method recently developed by the author are presented and discussed. Author

N74-14733 Ruhr Univ., Bochum (West Germany).

THE INFLUENCE OF WAVE DRAG ON HYPERSONIC ENTROPY WAKE OBSERVATIONS

Wolfgang Merzkirch and Alois Stilp (Ernst-Mach-Inst.) *In* AGARD Aerodyn. Drag Oct. 1973 6 p refs (For availability see N74-14709 06-01)

The conditions existing in the wake of a blunt hypersonic body are discussed. The two different flow regimes are defined as: (1) the viscous wake which originates from the separated boundary layer and (2) the inviscid or entropy wake formed by the streamlines which have traversed the curved part of the bow shock. The flow visualization of the entropy wake by schlieren photography is described. The observed schlieren pattern is analyzed with the aid of optical schlieren theory and can be related to the flight Mach number and the drag coefficient of the body. Author

N74-14734 Naval Air Systems Command, Washington, D.C.

DEVELOPMENT OF TECHNIQUES TO MEASURE IN-FLIGHT DRAG OF A US NAVY FIGHTER AIRPLANE AND CORRELATION OF FLIGHT MEASURED DRAG WITH WIND TUNNEL DATA

E. C. Rooney *In* AGARD Aerodyn. Drag Oct. 1973 18 p (For availability see N74-14709 06-01)

Wind tunnel and flight drag measurement techniques and correlation of wind tunnel and flight drag data for a U. S. Navy fighter airplane are discussed. Wind tunnel drag data were obtained with aerodynamic, induction system and powered nozzle/afterbody models. A common reference afterbody configuration between aerodynamic and propulsion models was utilized to assure compatibility of thrust and drag measurements. Flight drag data were obtained from steady-state, quasi steady-state and dynamic (wind-up/down turn) maneuvers utilizing sensitive three-axis accelerometers to determine excess thrust and the internal pressure method for measuring engine thrust. Compressor airflow, afterburner pressure drop and nozzle coefficients used for computing engine net thrust were obtained from isolated engine tests at simulated flight conditions throughout the flight envelope. Wind tunnel data were used to account for propulsion system drag caused by subcritical inlet spillage and nozzle interference drag. Author

N74-14735* National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

REVIEW OF DRAG MEASUREMENTS FROM FLIGHT TESTS OF MANNED AIRCRAFT WITH COMPARISONS TO WIND-TUNNEL PREDICTIONS

Jon S. Pyle and Edwin J. Saltzman *In* AGARD Aerodyn. Drag Oct. 1973 12 p refs (For availability see N74-14709 06-01)

In-flight studies of the overall and local components of drag of many types of aircraft were conducted. The primary goal of these studies was to evaluate wind-tunnel and semiempirical prediction methods. Some evaluations are presented in this paper which may be summarized by the following observations: Wind-tunnel predictions of overall vehicle drag can be accurately extrapolated to flight Reynolds numbers, provided that the base drag is removed and the boattail areas on the vehicle are small. The addition of ablated roughness to lifting body configurations causes larger losses in performance and stability than would be expected from the added friction drag due to the roughness. Successful measurements of skin friction have been made in flight to Mach numbers above 4. A reliable inflatable deceleration device was demonstrated in flight which effectively stabilizes and decelerates a lifting aircraft at supersonic speeds. Author

N74-14736 Royal Armament Research and Development Establishment, Fort Halstead (England).

AN ASSESSMENT OF THE ACCURACY OF TRANSONIC DRAG MEASUREMENT IN A LARGE MODERN WIND TUNNEL

R. K. Fancett and T. Smith *In* AGARD Aerodyn. Drag Oct. 1973 11 p refs (For availability see N74-14709 06-01)

The aeroballistic coefficients of bodies of revolution are needed for the mathematical modelling of their trajectories. The most significant coefficient required is zero yaw drag and the accuracy required is about 0.5% for a perfect trajectory model, compared with about 5% for lift and overturning moment. Lift, drag and overturning moment were measured over a range of yaw angles on two sting lengths in a 2.4 m x 2.7 m transonic wind tunnel. There was a marked difference in the measured drag values for these stings and a further investigation was made with five sting lengths. From these tests an empirical correction for the support system was derived which agreed well with a subsonic theoretical estimate. At speeds above Mach 1.0 the irregularity of the tunnel axial pressure distribution dominated the effects due to the support sytem and a combined correction was derived. It was found that the difference in measured values after correction was very much less than before, over the whole Mach number range, thus supporting the correction procedure applied. A statistical analysis of the residual coefficient errors has been summarized for the subsonic and transonic speed regions. The

transonic percentage errors were generally less than the subsonic values, due to the larger coefficient values measured. Author

N74-14737 City Univ., London (England). Dept. of Aeronautics.
STING INTERFERENCE EFFECTS ON AFTERBODIES AT TRANSONIC SPEEDS
D. M. Sykes *In* AGARD Aerodyn. Drag Oct. 1973 9 p refs (For availability see N74-14709 06-01)

The pressure distribution over the surface of three axisymmetric afterbodies at zero incidence has been measured and sting interference effects determined through the Mach number range from 0.70 to 1.15 in an octagonal, slotted wall wind tunnel. The afterbodies tested were a simple cylinder and conical boat-tails 1/2 calibre long with 7 1/2 deg angle and 1 calibre long with 9 deg angle, each carrying a representative driving band. Sting diameter effects were determined using 4 calibre long cylindrical stings of diameter 1/8, 1/4, 3/8 and 1/2 calibre, and stingflare interference effects were determined for a 10 deg semi-angle cone on a 1/4 calibre sting. The tests showed that the ratio of sting to base diameter was the main parameter for interference effects, but data for diameter effect from afterbodies with other geometries was not fully correlated using this parameter. Successful correlation with other data has been achieved for the proximity of conial flares of different angles for subsonic flow conditions. Author

N74-14738 Laboratoire de Recherches Balistiques et Aerodynamiques, Vernon (France).
MEASUREMENT OF DRAG IN A SHOCK TUNNEL [MESURES DE TRAINEE EN TUNNEL DE TIR]
Daniel Bahurel and Alain Desgardin *In* AGARD Aerodyn. Drag Oct. 1973 14 p refs In FRENCH (For availability see N74-14709 06-01)

After summarizing the principles of drag measurement in a shock tunnel, the different methods actually used are given: Cx constant, Cx as a function of incidence, and Cx as a function of Mach number. The accuracy of the methods is included. A series of results, obtained in the L.R.B.A. shock tunnel, on sphero-conic and cylindo-conic projectile slip over a broad range of Mach numbers and at 15 degree incidence angle are presented. Transl. by E.H.W.

N74-14739*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PLOTTING PROGRAM FOR AERODYNAMIC LIFTING SURFACE THEORY
Richard T. Medan and K. Susan Ray (Computer Sci. Corp., Mountain View, Calif.) Nov. 1973 31 p refs
(NASA-TM-X-62321) Avail: NTIS HC $3.75 CSCL 01A

A description of and users manual for a USA FORTRAN IV computer program which plots the planform and control points of a wing are presented. The program also plots some of the configuration data such as the aspect ratio. The planform data is stored on a disc file which is created by a geometry program. This program, the geometry program, and several other programs are used together in the analysis of lifting, thin wings in steady, subsonic flow according to a kernel function lifting surface theory. Author

N74-14740# Aeronautical Research Inst. of Sweden, Stockholm.
A QUICK LOOK AT THE STATE-OF-THE-ART IN FLIGHT TESTING OF CERTAIN AERODYNAMIC PARAMETERS RELATED TO WIND TUNNEL TESTING Final Report
A. Bertelrud 1973 78 p refs
(FFA-AU-966) Avail: NTIS HC $6.00 CSCL 01A

Flight test techniques and the accuracy that can be obtained with the instrumentation and data reduction procedures are discussed. An analysis of the extent to which wind tunnel tests can reproduce the actual characteristics of real aircraft was conducted. The subjects considered are: (1) buffeting, (2) skin friction, and (3) maximum lift/stall characteristics. The types of instrumentation required to obtain data on various aerodynamic characteristics are reported. Author

N74-14741*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A STUDY OF THE NONLINEAR AERODYNAMICS OF BODIES IN NONPLANAR MOTION Ph.D. Thesis - Stanford Univ., Calif.
Lewis Barry Schiff Washington Jan. 1974 94 p refs
(NASA-TR-R-421; A-5057) Avail: NTIS HC $3.75 CSCL 01A

Concepts from the theory of functionals are used to develop nonlinear formulations of the aerodynamic force and moment systems acting on bodies in large-amplitude, arbitrary motions. The analysis, which proceeds formally once the functional dependence of the aerodynamic reactions upon the motion variables is established, ensures the inclusion, within the resulting formulation, of pertinent aerodynamic terms that normally are excluded in the classical treatment. Applied to the large-amplitude, slowly varying, nonplanar motion of a body, the formulation suggests that the aerodynamic moment can be compounded of the moments acting on the body in four basic motions: steady angle of attack, pitch oscillations, either roll or yaw oscillations, and coning motion. Coning, where the nose of the body describes a circle around the velocity vector, characterizes the nonplanar nature of the general motion. Author

N74-14742# Naval Underwater Systems Center, Newport, R.I.
ANALYTICAL PREDICTION OF THE INFLUENCE OF POLYMER ADDITIVES ON THE SHEAR DRAG OF BODIES OF REVOLUTION
Frederick Laurent Test (R. I. Univ.) 3 Dec. 1973 29 p refs Backup document for AIAA Synoptic scheduled for publication in Journal of Hydronautics in April 1974
Avail: NTIS HC $3.50

An analytical method is presented for the determination of shear drag on a submerged body of revolution when a polymer additive is injected into the boundary layer. The analysis makes use of an integral momentum equation and a law-of-the-wall velocity profile that is adjusted for a pressure gradient and polymer addition. The results predict polymer wall concentration, boundary layer thickness, and wall shear stress as a function of distance along the surface of the body. The local wall shear stress both with and without polymer is integrated over the surface of the body in order to determine the drop in shear drag due to polymer addition. When applied to a half-body is a reduction in shear drag of 26% when Polyox WSR301 is injected into the boundary layer at 1.85% of the base rate and a 42% when injected at 7.4% of the base rate. Author

N74-14743# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
UNSTEADY LAMINAR SEPARATION OVER CYLINDERS STARTED IMPULSIVELY FROM REST
D. P. Telionis and D. Th. Tsahalis Nov. 1973 24 p refs Presented at 24th Intern. Astronaut. Congr. of the Intern. Astronaut. Fed., Baku, Oct. 1973
(Grant NSF GK-32622)
(VPI-E-73-29) Avail: NTIS HC $3.25

A numerical method is employed to integrate the unsteady laminar boundary layers about circular and elliptics cylinders started impulsively from rest. An upwind differencing scheme permits the integration through thin layers if reversed flow that are embedded in the boundary layer. The experimental results are compared with a numerical solution of the full Navier-Stokes equations and with small inner-outer expansion solutions. Author

N74-14744# National Aerospace Lab., Tokyo (Japan).
MEASUREMENTS OF ROLLING MOMENTS ACTING ON THE STABILIZER OF T-TAILS OSCILLATING IN YAW
Teruo Ichikawa, Koji Isogai, Yasukatsu Ando, and Hiroshi Ejiri 1973 10 p refs In JAPANESE; ENGLISH summary
(NAL-TR-324) Avail: NTIS HC $3.00

Low speed wind tunnel tests to determine aerodynamic rolling moments are discussed. Measurements were made of the forces acting on an isolated wing, with and without dihedral, at incidence and oscillating in yaw about the axis at the midchord point of the midspan. Tests were also conducted on the horizontal stabilizer of a T-tail configuration, with zero and finite angle of attack of the stabilizer, and oscillating in yaw about the axis through the fin midchord. Author

N74-14745*# Calspan Corp., Buffalo, N.Y.
ANALYSIS OF THE FLOW ABOUT DELTA WINGS WITH LEADING EDGE SEPARATION AT SUPERSONIC SPEEDS
Joseph P. Nenni and Chee Tung [1973] 43 p refs
(Contract NAS1-11577)
(NASA-CR-132358) Avail: NTIS HC $4.25 CSCL 01A

A research program was conducted to develop an improved theoretical flow model for the flow about sharp edge delta wings with leading-edge separation at supersonic speeds. The flow model incorporates a representation of the secondary separation region which occurs just inboard of the leading edge on such wings and is based on a slender-wing theory whereby the full three-dimensional problem is reduced to a quasi two-dimensional problem in the cross-flow plane. The secondary separation region was modeled by a surface distribution of singularities or a linearized type of cavity representation. The primary vortex and separation were modeled by a concentrated vortex and cut in the cross-flow potential which represents its feeding sheet. The cross-flow solutions for the cavity model were obtained, but these solutions have physical significance only in a very restricted range of angle of attack. The reasons for the failure of the flow model are discussed. The analysis is presented so that other interested researchers may critically review the work. Author

N74-14746# Advanced Technology Labs., Inc., Westbury, N.Y.
SIMILARITY PARAMETERS AND THEIR SENSITIVITY FOR TRANSONIC AIRFRAME EXHAUST NOZZLE INTERACTIONS Technical Report, 24 Jan. - 25 Sep. 1972
Gerald Roffe and Gabriel Miller Jan. 1973 75 p refs
(Contract F33615-72-C-1362; AF Proj. 1476)
(AD-768988; ATL-TR-175; AFFDL-TR-73-9) Avail: NTIS CSCL 01/1

A qualitative description of the fluid mechanics of transonic airframe interaction with engine exhaust flows is formulated and used to derive the pertinent similarity parameters of the problem. The sensitivity of the flow field to these parameters is explored by computations and analysis of available data and leads to the conclusion that viscous parameters such as boundary layer momentum thickness, engine exit flow profiles and mass flux ratio have a pronounced effect on simulation capability. Based on the findings of the similarity and sensitivity studies, experiments are outlined for both continuous and blowdown facilities to investigate the role of viscous parameters more fully.
Author (GRA)

N74-14747# Boeing Aerospace Co., Seattle, Wash. Research and Engineering Div.
EXHAUST SYSTEM INTERACTION PROGRAM Final Technical Report
John E. Postlewaite and Victor Salemann Jun. 1973 178 p refs
(Contract F33615-70-C-1450; AF Proj. 3066)
(AD-769086; D162-10467-13; AFAPL-TR-73-59) Avail: NTIS CSCL 01/3

The program consisted of two phases. The purpose of Phase 1 was to define what needs to be known, and when, and with what accuracy to define the engine cycle and thrust required by a proposed airplane, and to develop methods to obtain the required information -- particularly in the engine-exhaust system area. The second phase simulated the preliminary design and engine airframe matching portions of an airplane system development, stressing the evaluation of exhaust system installation losses at several levels of validity. This final report presents a summary of the work. The individual tasks are documented in seven volumes from Phase 1 (Vols. 1 - 7), ten volumes from Phase 1 (Vols. 8 - 17) of Ancilliary Reports (including D162-10467-12). Author (GRA)

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N74-14748# National Aeronautical Lab., Bangalore (India).
AERODYNAMIC ASPECTS OF THE PROBLEMS OF AIR-INTAKES AND EXHAUST FOR A SUPERSONIC TRANSPORT AIRCRAFT
J. Leynaert Nov. 1973 21 p refs Transl. into ENGLISH of "Aspects Aerodynamiques des Problemes de Prises d'Air et de Sorties de Reacteurs pour un Avion de Transport Supersoniques", French report ONERA-TP-124 Presented at Assoc. for Maritime and Aeronaut. Tech., Paris, 11-15 May 1964
(NAL-TR-194; NEAR-TP-124) Avail: NTIS HC $3.25

An overall view of the aerodynamic problem of air intakes and exhaust for a supersonic transport aircraft flying at 2.2. Mach no. is given from the point of view of the design of the air-intake and the after body of the jet engine for supersonic cruise speeds with adaptation to intermediate flight speeds. Particular attention is given to the prir..iple of boundary layer bleed at air-intake. Author

N74-14749# Institute of Transport Aviation, Paris (France).
AVIATION NEEDS AND PUBLIC CONCERNS
Emile VanLenner 29 Oct. 1973 22 p Presented at 7th Dr. Albert Plesman Mem. Lecture, Delft, Netherlands, 29 Oct. 1973
Avail: NTIS HC $3.25

Economic profits in the continuous growth of civil aviation are weighed against the social impact on human life in the building of Europe's transportation network. Problems of aircraft noise, demands on energy resources, airport congestion, and consequently of environmental control are considered. G.G.

N74-14750# Edizioni Museo Aeronautico Caproni di Taliedo, Rome (Italy).
FORTY YEARS OF CIVIL AVIATION, 1931 - 1971 [QUARANTANNI DI AVIAZIONE CIVILE, 1931 - 1971]
Maria Quilici 1973 77 p refs In ITALIAN
Avail: NTIS HC $6.00

A brief history of Italian civil aviation is presented. Articles published during this period are included. Transl. by F.O.S.

N74-14751*# Techtran Corp., Silver Spring, Md.
CALCULATION AND ANALYSIS OF AIRCRAFT MOTION
S. A. Gorbatenko, E. M. Makashov, Yu. F. Polushkin, and L. V. Sheftel Washington NASA Dec. 1973 379 p refs Transl. into ENGLISH of the book "Raschet i Analiz Dvizheniya Letatelnykh Apparatov" Moscow, Mashinostr., 1971 p 1-351
(Contract NASw-2485)
(NASA-TT-F-757) Avail: NTIS HC $8.00 CSCL 01B

Methods of calculating and analyzing motion, trajectories, transient processes, control and stability of aircraft are described. Calculation and properties of various guidance methods are discussed. Control based on linear automatic control theory, nonlinear mechanics and theory of stability of nonlinear systems are described. Problems of optimal control theory and methods of solution are explained. Numerical methods of calculating trajectories, transient processes, steady state flight and control optimization problems are presented. Author

N74-14752*# Kansas Univ. Center for Research, Inc., Lawrence.
FLIGHT TEST DATA FOR A CESSNA CARDINAL
David L. Kohlman Washington NASA Jan. 1974 35 p refs (Grant NGR-17-002-072)
(NASA-CR-2337; FRL-72-001) Avail: NTIS HC $3.00 CSCL 01C

The results of a flight test analysis of the performance of a standard Cessna 177B Cardinal airplane are presented. The airplane was fully instrumented to obtain steady state performance.

stick-fixed dynamic stability characteristics, and roll response data. Results obtained include graphs of C sub L versus alpha, C sub D versus C sub L, and speed-power relationships. Dynamic data include Phugoid and Dutch characteristics, and roll response characteristics. Author

N74-14753*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
HFL-10 LIFTING BODY FLIGHT CONTROL SYSTEM CHARACTERISTICS AND OPERATIONAL EXPERIENCE
Weneth D. Painter and George J. Sitterle Washington Jan. 1974 35 p refs
(NASA-TM-X-2956; H-704) Avail: NTIS HC $3.00 CSCL 01C

A flight evaluation was made of the mechanical hydraulic flight control system and the electrohydraulic stability augmentation system installed in the HL-10 lifting body research vehicle. Flight tests performed in the speed range from landing to a Mach number of 1.86 and the altitude range from 697 meters (2300 feet) to 27,550 meters (90,300 feet) were supplemented by ground tests to identify and correct structural resonance and limit-cycle problems. Severe limit-cycle and control sensitivity problems were encountered during the first flight. Stability augmentation system structural resonance electronic filters were modified to correct the limit-cycle problem. Several changes were made to control stick gearing to solve the control sensitivity problem. Satisfactory controllability was achieved by using a nonlinear system. A limit-cycle problem due to hydraulic fluid contamination was encountered during the first powered flight, but the problem did not recur after preflight operations were improved. Author

N74-14754*# General Electric Co., Pittsfield, Mass.
ANALYSIS AND CALCULATION OF LIGHTNING-INDUCED VOLTAGES IN AIRCRAFT ELECTRICAL CIRCUITS Final Report
J. A. Plumer Washington NASA Jan. 1974 65 p refs
(Contract NAS3-14836)
(NASA-CR-2349; SRD-72-066) Avail: NTIS HC $3.50 CSCL 01C

Techniques to calculate the transfer functions relating lightning-induced voltages in aircraft electrical circuits to aircraft physical characteristics and lightning current parameters are discussed. The analytical work was carried out concurrently with an experimental program of measurements of lightning-induced voltages in the electrical circuits of an F89-J aircraft. A computer program, ETCAL, developed earlier to calculate resistive and inductive transfer functions is refined to account for skin effect, providing results more valid over a wider range of lightning waveshapes than formerly possible. A computer program, WING, is derived to calculate the resistive and inductive transfer functions between a basic aircraft wing and a circuit conductor inside it. Good agreement is obtained between transfer inductances calculated by WING and those reduced from measured data by ETCAL. This computer program shows promise of expansion to permit eventual calculation of potential lightning-induced voltages in electrical circuits of complete aircraft in the design stage. Author

N74-14755*# Washington Univ., St. Louis, Mo. School of Engineering and Applied Science.
CONCEPTS FOR A THEORETICAL AND EXPERIMENTAL STUDY OF LIFTING ROTOR RANDOM LOADS AND VIBRATIONS, PHASE 1
Kurt H. Hohenemser and Gopal H. Gaonkar Sep. 1967 74 p refs
(Contract NAS2-4151)
(NASA-CR-114707) Avail: NTIS HC $5.75 CSCL 01C

A number of lifting rotor conditions with random inputs are discussed. The present state of random process theory, applicable to lifting rotor problems is sketched. Possible theories of random blade flapping and random blade flap-bending are outlined and their limitations discussed. A plan for preliminary experiments to study random flapping motions of a see-saw rotor is developed. Author

N74-14756*# Washington Univ., St. Louis, Mo. School of Engineering and Applied Science.
CONCEPTS FOR A THEORETICAL AND EXPERIMENTAL STUDY OF LIFTING ROTOR RANDOM LOADS AND VIBRATIONS, PHASE 2
Kurt H. Hohenemser and Gopal H. Gaonkar Aug. 1968 56 p refs
(Contract NAS2-4151)
(NASA-CR-114708) Avail: NTIS HC $5.00 CSCL 01C

A comparison with NASA conducted simulator studies has shown that the approximate digital method for computing rotor blade flapping responses to random inputs, tentatively suggested in Phase I Report, gives with increasing rotor advance ratio the wrong trend. Consequently, three alternative methods of solution have been considered and are described: (1) an approximate method based on the functional relation between input and output double frequency spectra, (2) a numerical method based on the system responses to deterministic inputs and (3) a perturbation approach. Among these the perturbation method requires the least amount of computation and has been developed in two forms - the first form to obtain the response correlation function and the second for the time averaged spectra of flapping oscillations. Author

N74-14757*# Washington Univ., St. Louis, Mo. School of Engineering and Applied Science.
CONCEPTS FOR A THEORETICAL AND EXPERIMENTAL STUDY OF LIFTING ROTOR RANDOM LOADS AND VIBRATIONS (THE EFFECTS OF SOME ROTOR FEEDBACK SYSTEMS ON ROTOR-BODY DYNAMICS), PHASE 7-A
Kurt H. Hohenemser and S. K. Yin Jun. 1973 92 p refs
(Contract NAS2-4151)
(NASA-CR-114709) Avail: NTIS HC $6.75 CSCL 01C

The effects of three gyroless rotor feedback systems: (1) coning feedback, (2) proportional tilting feedback, and (3) a combination of these on the rotor-body dynamics of hingeless rotorcraft are studied with a simplified analytical model in the advance ratio range from 0 to .8. Combinations of feedback phase angles and control phase angles are selected to minimize control cross coupling and control sensitivity changes between low and high speed flight. For the feedback systems thus selected the effects of feedback gain and control actuator time lag on the stability both with fixed hub and in free flight is studied, whereby the rotorcraft is free in pitch, roll and vertical motion but otherwise restrained. For the free flight is studied, whereby the rotorcraft is free in pitch, roll and vertical motion but otherwise restrained. For the free flight conditions the effects of a horizontal tail are also determined in itself and in combination with the rotor feedback systems. Author

N74-14758*# Washington Univ., St. Louis, Mo. School of Engineering and Applied Science.
CONCEPTS FOR A THEORETICAL AND EXPERIMENTAL STUDY OF LIFTING ROTOR RANDOM LOADS AND VIBRATIONS (IDENTIFICATION OF LIFTING ROTOR SYSTEM PARAMETERS FROM TRANSIENT RESPONSE DATA), PHASE 7-B
Kurt H. Hohenemser and D. A. Prelewicz Jun. 1973 39 p refs
(Contract NAS2-4151)
(NASA-CR-114710) Avail: NTIS HC $4.00 CSCL 01C

System identification methods have been applied to rotorcraft to estimate stability derivatives from transient flight control response data. While these applications assumed a linear constant coefficient representation of the rotorcraft, the computer experiments used transient responses in flap-bending and torsion of a rotor blade at high advance ratio which is a rapidly time varying periodic system. It was found that a simple system identification method applying a linear sequential estimator also called least square estimator or equation of motion estimator, is suitable for this periodic system and can be used directly if only the acceleration data are noise polluted. In the case of noise being present also in the state variable data the direct application of the estimator gave poor results. Author

N74-14759*# Washington Univ., St. Louis, Mo. School of Engineering and Applied Science.
CONCEPTS FOR A THEORETICAL AND EXPERIMENTAL STUDY OF LIFTING ROTOR RANDOM LOADS AND VIBRATIONS (FURTHER EXPERIMENTS WITH PROGRESS-

ING/REGRESSING ROTOR FLAPPING MODES), PHASE 7-C
Kurt H. Hohenemser and S. T. Crews Jun. 1973 76 p refs (Contract NAS2-4151)
(NASA-CR-114711) Avail: NTIS HC $6.00 CSCL 01C

The experiments with progressing/regressing forced rotor flapping modes have been extended in several directions and the data processing method has been considerably refined. The 16 inch hingeless 2-bladed rotor model was equipped with a new set of high precision blades which removed previously encountered tracking difficulties at high advance ratio, so that tests up to .8 rotor advance ratio could be conducted. In addition to data with 1.20 blade natural flapping frequency data at 1.10 flapping frequency were obtained. Outside the wind tunnel, tests with a ground plate located at different distances below the rotor were conducted while recording the dynamic downflow at a station .2R below the rotor plane with a hot wire anemometer. Author.

N74-14760*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
PERFORMANCE OF A BALLUTE DECELERATOR TOWED BEHIND A JET AIRPLANE
Jon S. Pyle, James R. Phelps, and Robert S. Baron Dec. 1973 26 p refs
(NASA-TM-X-56019; H-815) Avail: NTIS HC $3.50 CSCL 01C

An F-104B airplane was modified to investigate the drag and stability characteristics of a ballute decelerator in the wake of an asymmetrical airplane. Decelerator deployments were initiated at a Mach number of 1.3 and an altitude of 15,240 meters (50,000 feet) and terminated when the airplane had decelerated to a Mach number of 0.5. The flight tests indicated that the decelerator had a short inflation time with relatively small opening forces. The drag levels attained with the subject decelerator were less than those obtained with other high-speed decelerators behind a symmetrical tow vehicle. The ballute demonstrated good stability characteristics behind the testbed airplane. Author

N74-14761*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF CONFIGURATION VARIATION ON EXTERNALLY BLOWN FLAP NOISE
Robert G. Dorsch, Jack H. Goodykoontz, and Noel B. Sargent 1974 33 p refs Presented at 12th Aerospace Sci. Meeting, Washington, D. C., 30 Jan. - 1 Feb. 1974; sponsored by AIAA
(NASA-TM-X-71495; E-7858) Avail: NTIS HC $3.75 CSCL 01C

The sensitivity of flap interaction noise to variations in engine-under-the-wing externally blown flap geometry was investigated with a large cold-flow model. Both 2- and 3-flap wing sections (7-ft chord) with trailing flap angles up to 60 deg were employed. Exhaust nozzles included coaxial, plug, and 8- and 13-inch diameter conical configurations. These nozzles were tested at two positions below the wing. The effects of these geometry variations on noise level, directivity, and spectral shape are summarized in terms of exhaust flow parameters evaluated at the nozzle exit and at the flap impingement station. The results are also compared with limited flap noise data available from tests using real engines. Author

N74-14762*# General Dynamics/Convair, San Diego, Calif. Convair Aerospace Div.
COMPUTER PROGRAM TO PERFORM COST AND WEIGHT ANALYSIS OF TRANSPORT AIRCRAFT. VOLUME 1: SUMMARY Final Report
Nov. 1973 92 p refs
(Contract NAS1-11343)
(NASA-CR-132361) Avail: NTIS HC $6.75 CSCL 01C

A digital computer program for evaluating the weight and costs of advanced transport designs was developed. The resultant program, intended for use at the preliminary design level, incorporates both batch mode and interactive graphics run capability. The basis of the weight and cost estimation method developed is a unique way of predicting the physical design of each detail part of a vehicle structure at a time when only configuration concept drawings are available. In addition, the technique relies on methods to predict the precise manufacturing processes and the associated material required to produce each detail part. Weight data are generated in four areas of the program. Overall vehicle system weights are derived on a statistical basis as part of the vehicle sizing process. Theoretical weights, actual weights, and the weight of the raw material to be purchased are derived as part of the structural synthesis and part definition processes based on the computed part geometry. Author

N74-14763*# General Dynamics/Convair, San Diego, Calif. Convair Aerospace Div.
COMPUTER PROGRAM TO PERFORM COST AND WEIGHT ANALYSIS OF TRANSPORT AIRCRAFT. VOLUME 2: TECHNICAL VOLUME Final Report
Nov. 1973 185 p refs
(Contract NAS1-11343)
(NASA-CR-132362) Avail: NTIS HC $11.25 CSCL 01C

An improved method for estimating aircraft weight and cost using a unique and fundamental approach was developed. The results of this study were integrated into a comprehensive digital computer program, which is intended for use at the preliminary design stage of aircraft development. The program provides a means of computing absolute values for weight and cost, and enables the user to perform trade studies with a sensitivity to detail design and overall structural arrangement. Both batch and interactive graphics modes of program operation are available. Author

N74-14764# National Aerospace Lab., Tokyo (Japan).
GROUND OPERATION TESTS OF FLYING TEST BED FOR VTOL AIRCRAFT AT NATIONAL AEROSPACE LABORATORY
Naoto Takizawa, Yoshikazu Tanabe, Akiyoshi Shibuya, Toshio Ogawa, Hirotoshi Fujieda, Tadao Kai, Yoshito Miyamoto, Koichi Ono, and Tadao Torisaki 1973 57 p refs In JAPANESE; ENGLISH summary
(NAL-TR-319) Avail: NTIS HC $5.00

The ground operation tests of a flying test bed designed to investigate problems of hovering, vertical takeoff, and landing of vertical takeoff aircraft are discussed. During the tests, the flying test bed was fixed on a force test stand at a height of about six feet and controlled remotely from a control room. Total engine running time was about five hours in forty four operations and approximately thirty items were measured in each operation by special wiring, telemetry, and other methods. Author

N74-14765*# Boeing Vertol Co., Philadelphia, Pa.
A STUDY OF THE EFFECT OF FLIGHT DENSITY AND BACKGROUND NOISE ON V/STOL ACCEPTABILITY Final Report
Harry Sternfeld, Jr., Ernest G. Hinterkeuser, Roy B. Hackman, and Jerry Davis Washington NASA Jan. 1974 84 p refs (Contract NAS1-11607)
(NASA-CR-2197; D210-10662-2) Avail: NTIS HC $3.75 CSCL 01C

A study was conducted in which test subjects evaluated the sounds of a helicopter, a turbofan STOL and a turbojet airplane while engaged in work and leisure activities. Exposure to a high repetitive density of the aircraft sounds did not make the individual sounds more annoying but did create an unacceptable environment. The application of a time duration term to db(A) resulted in a measure which compared favorably with EPNL as a predictor of annoyance. Temporal variations in background noise level had no significant effect on the rated annoyance. Author

N74-14766# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.
CALCULATION OF THE INDUCED VELOCITY FIELD ON AND OFF THE WING PLANE FOR A SWEPT WING WITH GIVEN LOAD DISTRIBUTION
C. C. L. Sells London Aeron. Res. Council 1973 41 p refs Supersedes RAE-TR-69231; RAE-TR-70146; ARC-32144; ARC-32549
(ARC-R/M-3725; RAE-TR-69231; RAE-TR-70146; ARC-32144; ARC-32549) Avail: NTIS HC $4.25; HMSO £1.55; PHI $6.25

Computer programs have been written to evaluate the

integrals of lifting-surface theory for the velocity field of a thin wing with given load distribution. Different programs are used for the downwash at points on the wing and for any or all three velocity components off the wing. The heart of the programs is an analytic evaluation of the spanwise integral over a short line following the local sweep; by combining a number of such integrals, the complete integral over the wing is built up. Both programs were tested by comparison with other results. The downwash program cannot compute the downwash at the apex of a swept wing with rounded isobars, nor exactly at a wing tip. Author (ESRO)

N74-14767# Royal Aircraft Establishment, Farnborough (England). Structures Dept.

SIMILARITY REQUIREMENTS FOR AEROELASTIC MODELS OF HELICOPTER ROTORS

G. K. Hunt London Aeron. Res. Council 1973 35 p refs Supersedes RAE-TR-72005, ARC-33730

(ARC-CP-1245; RAE-TR-72005; ARC-33730) Avail: NTIS HC $3.75; HMSO 55p; PHI $2.35

The parameters determining the dynamic similarity of flexible lifting rotors, ignoring thermal effects, are identified. Their relative importance is discussed and practical design procedures are developed for aeroelastic helicopter rotor models. A model should satisfy six similarity requirements. The full-scale Mach number and Froude number cannot be represented at the same time, and the full-scale Reynolds number cannot be represented at all. Hence models will generally be designed to achieve either Mach number or Froude number similarity. The uses, limitations, and characteristics of each kind of model are examined, and the interpretation of measurements obtained from them is explained. Most models are likely to be structural replicas, and the problems of making such models are discussed. The quality of construction, necessary to ensure that the models yield reliable experimental data, is shown to be high. Author (ESRO)

N74-14768# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.

COMPARISON OF THE FLYING QUALITIES OF THE A-7D AIRCRAFT WITH THE REQUIREMENTS OF MIL-F-8785B ASG Technical Report, Mar. - Dec. 1972

Daryl J. Joseph Apr. 1973 232 p refs

(AD-768390; ASD-TR-73-15) Avail: NTIS CSCL 01/3

The report compares the flying qualities of the A-7D light attack airplane with the major flying qualities items of the Military Specification MIL-F-8785B(ASG). The comparison is based primarily on theoretical data supplemented as required by flight test data. The theoretical data is obtained from the contractor's report number 2-53320/8R-8089, dated 15 January 1968. The A-7D is aerodynamically the same as the A-7A; therefore, the A-7D estimated flying qualities are based on data obtained from flight tests of the A-7A airplane and A-7A model tests in the contractor's wind tunnel. Author (GRA)

N74-14769# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

APPLICATION OF THE AEROSPACE MULTIPROCESSOR TO THE A-7D FLIGHT CONTROL SYSTEM M.S. Thesis

Robert Russell Summers Jun. 1973 103 p refs

(AF Proj. 6090)

(AD-768382; GGC/EE/73-17) Avail: NTIS CSCL 01/4

The application of the Aerospace Multiprocessor as the flight control computer for a digital fly-by-wire control system for the A-7D aircraft is described. First a brief discussion of the evolution of flight control systems, ranging from mechanical to digital fly-by-wire, is presented. Next, the topic of digital computers for aircraft flight control is covered. First general computer characteristics are discussed. This is followed by an extensive discussion of Aerospace Multiprocessor characteristics and principles of operation. The present analog flight control system for the A-7D aircraft is described. Various methods of digitizing the A-7D flight control system are considered. The Tustin method of digitization is covered at length, and difference equation derivations are shown in detail. The flight control microprogram written for the Aerospace Multiprocessor is described at a flowchart level. A multiply subroutine, written during this study, is described in detail. Then a description is given of the laboratory tests that were made with the Aerospace Multiprocessor programmed for flight control. Test results are discussed. Finally, the Aerospace Multiprocessor is evaluated regarding its suitability for use in a flight control application. Author (GRA)

N74-14770# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.

LDF POWERED BALLOON PROGRAM Instrumentation Papers

Arthur O. Koran, Richard C. Leclaire, and Catherine B. Rice 18 Jul. 1973 48 p refs

(AD-768673; AFCRL-TR-73-0424; ACRL-IP-198) Avail: NTIS CSCL 01/3

The report describes POBAL, a test flight to demonstrate the feasibility of accomplishing station-keeping by powering a 711,000-cu. ft. free balloon against the wind in the minimum wind field near 60,000-ft altitude. The propulsion system, fabricated from off the shelf components, incorporated a 35-ft diameter helicopter rotor and an 8-hp electric motor powered by Ag-Zn batteries. Line of thrust was controlled by a 9-ft high rudder, steerable either by radio command or by autopilot. POBAL was flown from Holloman AFB, New Mexico in September 1972. System components, flight results, recommendations and feasibility studies for a long duration POBAL system are discussed. Author (GRA)

N74-14771# Army Missile Command, Redstone Arsenal, Ala.

METHODS FOR REDUCING VIBRATIONS OF EQUIPMENT MOUNTED ON HELICOPTER EXTERNAL STORES STATIONS

James M. Oliver 6 Aug. 1973 59 p refs

(DA Proj. 1M2-62303-A-214)

(AD-768774; RL-TR-73-6) Avail: NTIS CSCL 19/7

Three designs for reducing the vertical oscillations induced in equipment mounted on the wings of AH-1G helicopters are submitted. A design for a variable stiffness spring to accommodate a change in the mass of the system to be isolated is presented. By use of an analog simulation of a dynamic absorber it is shown that a dynamic absorber is not satisfactory for small ratios of damper mass to system mass. An experimental program is formulated to determine the dynamic properties of a test fixture to be used in determining isolator effectiveness. Author (GRA)

N74-14772# Army Cold Regions Research and Engineering Lab., Hanover, N.H.

OPERATIONAL EVALUATION OF THE SK-5 AIR CUSHION VEHICLE IN ALASKA

Ronald A. Liston Sep. 1973 44 p refs

(AD-768781; CRREL-TR-243) Avail: NTIS CSCL 01/3

The report discusses the evaluation of the SK-5 air cushion vehicle, during operations on terrain typical of central Alaska. The intent of the evaluation was to consider the SK-5 as representative of the state of the art rather than as a candidate for a specific military role in Alaska. The study included tests to: determine slope-climbing ability, measure skirt drag, identify maneuverability as a function of surface conditions; determine air flow characteristics through the gap between the skirt and ground; and to identify the change in cushion pressure as a function of obstacle geometry. The test procedures and results are discussed. Conclusions for each test are drawn as is an overall conclusion concerning the potential value of air cushion vehicles in helping to solve Alaskan transportation problems. Author (GRA)

N74-14773# LTV Aerospace Corp., Dallas, Tex. Vought Systems Div.

DEFINITION OF STUDY OBJECTIVES FOR INTEGRATED CREW MODULE DEVELOPMENT Final Report, 1 Jul. 1972 - 31 Aug. 1973

E. R. Atkins, J. C. Hodges, T. L. Harper, J. R. Hankine, and A. A. Hall Aug. 1973 264 p refs

(Contract N00014-72-C-0443; NR Proj. 213-106)

(AD-769065; Rept-2-57110/3R-3104; JANAIR-730705) Avail: NTIS CSCL 01/2

A study was conducted to identify and qualify objectives in the development of the integrated crew module crew station. The study efforts encompassed the man factor in addressing

crew performance and the machine factor through analysis of critical design factors such as: (1) anthropometry, (2) geometry, (3) controls and displays, (4) vision, and (5) arrangement. A baseline configuration was developed from the studies. A significant portion of the study was devoted to the supine position of the crew member for acceleration tolerance improvement.
Author

N74-14774# Northrop Corp., Hawthorne, Calif. Electronics Div.
IN-FLIGHT STABILIZATION OF EXTERNALLY SLUNG HELICOPTER LOADS Final Report, 25 Jun. 1970 - 17 Jun. 1972
David T. Liu May 1973 237 p refs
(Contract DAAJ02-70-C-0067; DA Proj. 1F1-62203-A-435)
(AD-769063; NORT-72-39; USAAMRDL-TR-73-5) Avail: NTIS CSCL 01/3

The purpose of the study was to select the best technical approaches for stabilizing a wide spectrum of externally slung helicopter loads at forward speeds up to 150 knots equivalent air speed (KEAS). This effort was accomplished in a two-phase program. Phase I was designed to identify and characterize typical sling loads, to establish their aerodynamic and dynamic characteristics, to gain physical understanding of helicopter/sling-load coupling dynamics, and to develop design approaches for stabilizing devices together with criteria and methodology for cost-effectiveness analysis. Phase II was devoted to the performance of a trade-off study of load stabilization systems, the formulation of preliminary design concepts for the most effective load stabilization approaches, and an evaluation of candidate stabilization systems using a moving-base flight simulator. (Modified author abstract) GRA

N74-14775# Mechanical Technology, Inc., Latham, N.Y.
RECOMMENDED DESIGN MODIFICATIONS TO THE CH-47 FORWARD ROTOR DRIVE GEARBOX
Robert H. Badgley Jun. 1973 89 p refs
(Contract DAAJ02-72-C-0040; DA Proj. 1G1-62207-AA-72)
(AD-769062; MTI-73TR1; USAAMRDL-TR-73-33) Avail: NTIS CSCL 01/3

The report describes the results of a study of modifications to existing helicopter power-train hardware for the purpose of reducing acoustic-frequency vibrations and noise. Mechanical vibration analysis methods were put to further tests by applying them to the redesign of CH-47C gearbox components. This program was undertaken carefully and methodically to avoid the excessive costs which often accompany hit-or-miss approaches to gearbox noise reduction. The results include vibration reduction predictions for a number of carefully documented designs. The key products in this overall effort are reduced bearing radial dynamic forces; thus, the results of this program are expected to have major impact upon bearing and gear lifetimes, in addition to the obvious benefits in the area of gearbox noise. (Modified author abstract) GRA

N74-14776# Naval Ordnance Lab., White Oak, Md.
EFFECTS OF CANOPY GEOMETRY ON THE INFINITE MASS OPENING-SHOCK FACTOR OF A CROSS PARACHUTE WITH A W/L RATIO OF 0.264
William P. Ludtke 31 Jul. 1973 20 p refs
(ZF61512001)
(AD-768755; NOLTR-73-157) Avail: NTIS CSCL 01/3

The effects of cloth permeability, number of suspension lines, and suspension line length on the infinite mass opening-shock factor of the cross parachute were investigated in a wind tunnel. Forty-inch-diameter models with a canopy arm-to-length ratio (W/L) of 0.264 were deployed at wind-tunnel velocities of 150 or 200 miles per hour. Results of these tests indicate that cloth permeability influences the infinite mass shock factor significantly. A decrease in the cloth permeability results in an increase in the shock factor. Suspension line length and number of suspension lines do not appreciably affect the shock factor. The steady-state drag coefficients are affected by the cloth and suspension line parameters. Author (GRA)

N74-14777# Army Materiel Systems Analysis Agency, Aberdeen Proving Ground, Md.
SIMPLIFIED AIRCRAFT PERFORMANCE METHODS: POWER REQUIRED FOR SINGLE AND TANDEM ROTOR HELICOPTERS IN HOVER AND FORWARD FLIGHT
C. Raymond Dietz Aug. 1973 57 p refs
(AD-768769; AMSAA-TR-78) Avail: NTIS CSCL 01/3

The report presents a combination graphic and computing method for quick determination of shaft horsepower required for helicopters in hover and forward flight. Sets of equations were developed for computing power required. These equations are based upon theory and test data and show good agreement with published power required data on many currently operating helicopters. The equations have also been programmed for digital computation thereby making possible detailed studies of helicopter performance and the effects of parametric variations.
Author (GRA)

N74-14778# Southwest Research Inst., San Antonio, Tex.
ENGINEERING APPRAISAL OF SOUTHWEST RESEARCH INSTITUTE MAGNETIC CRACK DEFINER APPLIED TO CH47 ROTOR BLADES
J. Robert Birchak, Robert R. King, C. Gerald Gardner, and John R. Barton Oct. 1973 57 p refs
(Contract DAAJ01-73-C-0533)
(AD-769068; SwRI-15-3653; USAAVSCOM-TR-73-20) Avail: NTIS CSCL 14/2

The Magnetic Crack Definer (MCD), a nondestructive evaluation device recently developed at Southwest Research Institute, was evaluated to determine the applicability for detecting fatigue cracks in CH-47 helicopter rotor blade spars (AISI 4340) in the fully assembled blade. For test purposes, fatigue cracks were produced by cyclically stressing several sheet specimens cut from a spar from a scrap blade. Several different probe configurations and other system parameters of the MCD were investigated, and after optimizing overall design, cracks as small as 0.3-inch long by 0.025-inch deep were reliably detected under the major adverse conditions associated with the blade, namely: varying lift-off up to 0.10-inch; and different types of overlaying materials, including stainless steel, fiberglass, mastic and adhesive. Additional investigations are recommended to determine the capability for detecting fatigue cracks under the ferromagnetic steel doubler plates, and to determine possible sources of false alarms. Author (GRA)

N74-14779# Hercules, Inc., Magna, Utah. Bacchus Works.
GRAPHITE COMPOSITE LANDING GEAR COMPONENTS - SIDE BRACE ASSEMBLY AND TORQUE LINK FOR A37-B AIRCRAFT Final Report, 15 May 1971 - 15 May 1973
R. E. Randolph, J. Witzel, J. N. Burns, H. L. T. Pritt, and J. C. Samisis 15 May 1973 150 p refs
(Contract F33615-71-C-1508; AF Proj. 1369)
(AD-769041; H400-12-1-17; FFDL-TR-73-6923) Avail: NTIS CSCL 01/3

The effort deals with the design, fabrication and testing of three separate components of the main landing gear for A37B aircraft. Specifically, the upperside brace, lower side brace, and torque arm are involved. Designs of point loaded graphite/epoxy composite landing gear components along with their fabrication, including the use of chopped graphite/epoxy curing molds, are presented. The program demonstrated that complex components can be fabricated using chopped and continuous graphite/epoxy to withstand the static and fatigue loads encountered by the production metal components in service. Component weight savings as great as 50 percent have been achieved. (Modified author abstract) GRA

N74-14780# Army Aviation Systems Command, St. Louis, Mo. Systems Performance Assessment Div.
MAJOR ITEM SPECIAL STUDY (MISS), AH-1G DRIVESHAFT ASSEMBLY, MAIN TRANSMISSION TO ENGINE Interim Report, 1 Jan. 1964 - 30 Jun. 1972
Oct. 1973 23 p
(AD-768763; USAAVSCOM-TR-73-26) Avail: NTIS CSCL 01/3

An analysis of the failures occurring with the H-1 helicopter and AH-1G helicopter drive shafts was conducted. The effects of the failures on logistics, spare parts, aircraft maintenance, and helicopter availity are described. The quality control and cost effective aspects of continuing to use the drive shafts are analyzed. P.N.F.

N74-14781# Radio Corp. of America, Burlington, Mass. Aerospace Systems Div.
HELICOPTER INSPECTION DESIGN REQUIREMENTS
Douglas O. Blake, Fred W. Hohn, and Frank E. Starses May 1973 215 p refs
(Contract DAAJ02-72-C-0052; DA Proj. 1F1-62201-A-119)
(AD-769061; USAAMRDL-TR-73-22) Avail: NTIS CSCL 01/3

Existing aircraft and presently used inspection techniques were analyzed to determine the impact of present design on the ease of inspection. Initial engineering analyses established failure modes and inspection techniques for helicopter components which contribute significantly to the inspection problem. Analysis results were supplemented by field interviews with inspectors experienced in inspection of six aircraft types (AH-1, UH-1, CH-47, CH-54, OH-58, and OH-6). The field survey helped definitize components in each aircraft which present inspection problems. Problem areas were then reviewed and classified into categories. These categories included candidates for component or installation redesign, and changes in inspection technique or interval. Engineering analyses then explored for worthwhile solutions. This report contains the resulting specific recommendations for design approaches which offer improvements in inspection efficiency in future designs and inspection aids which warrant consideration for application to present or future designs. The MAVIS (Model for Analysis of Vehicle Inspection Systems) computer model, described in USAAMRDL Technical Report 72-35, was used to assess quantitatively the improvements in inspection efficiency available through the adoption of the study's recommendations. The modeling indicated significant reduction in maintenance man-hour requirements and improvement in aircraft availability and mission reliability. Author (GRA)

N74-14782# Army Aviation Systems Command, St. Louis, Mo.
MAJOR ITEM SPECIAL STUDY (MISS), AH-1G MAST ASSEMBLY Interim Report, Jan. 1964 - Jun. 1972
Oct. 1973 32 p
(AD-768764; USAAVSCOM-TR-73-25) Avail: NTIS CSCL 01/3

The report describes a failure analysis performed on a helicopter antenna mast assembly. GRA

N74-14783# Douglas Aircraft Co., Inc., Long Beach, Calif.
DEVELOPMENT OF A GRAPHITE HORIZONTAL STABILIZER Interim Technical Report, 1 Jan. - 30 Jun. 1973
George M. Lehman, D. M. Purdy, A. Cominski, C. G. Dietz, and R. Teodosiadis Jul. 1973 82 p refs
(Contract N00156-70-C-1321)
(AD-768869; MDC-J6080) Avail: NTIS CSCL 01/3

The results of analyses and development component tests of the redesigned graphite horizontal stabilizer are presented. The upper and lower skin panels were redesigned with bonded internal stepped-lap titanium doublers at the main pivot and actuator fitting interfaces. The minimum predicted margin-of-safety for the redesigned pivot joint structure is 29% at the first fastener outboard of the titanium doubler. Three development components were fabricated and tested to verify the static and fatigue load capacities of the pivot joint and the static load capacity of the actuator joint. The pivot joint development component attained a static ultimate load of 170% Design Limit Load (DLL) and a residual static ultimate load of 195% DLL after 12,000 hours of simulated fatigue spectrum loading. The actuator joint development component attained a static ultimate load of 195% DLL. The calculated weight of the graphite structure is 183 pounds, an increase of approximately six pounds for the structural redesign, and a reduction of 26% in comparison with the conventional metal structure. Fabrication techniques for the upper and lower skin panels are discussed. Engineering drawings, quality control test results, and the test plan for the second stabilizer unit are included in appendices. Author (GRA)

N74-14727 Boeing Commerical Airplane Co., Renton, Wash.
THE PROBLEM OF INSTALLING A MODERN HIGH BYPASS ENGINE ON A TWIN JET TRANSPORT AIRCRAFT
Walter C. Swan and Armand Sigalla *In* AGARD Aerodyn. Drag Oct. 1973 12 p (For availability see N74-14709 06-01)

N74-15612 British Aircraft Corp., Preston (England). Military Aircraft Div.
OPTIMISATION OF AIRCRAFT STRUCTURES WITH MULTIPLE STIFFNESS REQUIREMENTS
I. C. Taig and R. I. Kerr *In* AGARD Second Symp. on Structural Optimization Nov. 1973 14 p refs (For availability see N74-15596 06-32)

N74-15614 Messerschmitt-Boelkow-Blohm G.m.b.H., Hamburg (West Germany). Stress Dept.
OPTIMIZATION AND DESIGN OF THE REAR FUSELAGE OF THE A 300 B AIRCRAFT STRUCTURE
D. Schulz *In* AGARD Second Symp. on Structural Optimization Nov. 1973 15 p refs (For availability see N74-15596 06-32)

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines, hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; Nuclear Engineering; and 28 Propulsion Systems.

N74-14784* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METHOD OF MAKING SILICON SOLAR CELL ARRAY Patent
Americo F. Forestieri, Jacob D. Broder, and Daniel T. Bernatowicz, inventors (to NASA) Issued 25 Dec. 1973 4 p Filed 26 Oct. 1970 Supersedes N71-29048 (09 - 16, p 2541)
(NASA-Case-LEW-11069-1; US-Patent-3,780,424; US-Patent-Appl-SN-83816; US-Patent-Class-29-572; US-Patent-Class-136-89; US-Patent-Class-29-588) Avail: US Patent Office CSCL 10C

A heat sealable transparent plastic film, such as a flourinated ethylene propylene copolymer, is used both as a cover material and as an adhesive for mounting a solar cell array to a flexible substrate. Official Gazette of the U.S. Patent Office

N74-14785*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
IMPINGING JET SEPARATORS FOR LIQUID METAL MAGNETOHYDRODYNAMIC POWER CYCLES
David W. Bogdanoff 1 Dec. 1973 155 p refs Sponsored in part by NAS-NRC
(Contract NAS7-100)
(NASA-CR-136552; JPL-TM-33-621) Avail: NTIS HC $9.75 CSCL 10A

In many liquid metal MHD power, cycles, it is necessary to separate the phases of a high-speed liquid-gas flow. The usual method is to impinge the jet at a glancing angle against a solid surface. These surface separators achieve good separation of the two phases at a cost of a large velocity loss due to friction at the separator surface. This report deals with attempts to greatly reduce the friction loss by impinging two jets against each other. In the crude impinging jet separators tested to date, friction losses were greatly reduced, but the separation of the two phases was found to be much poorer than that achievable with surface separators. Analyses are presented which show many lines of attack (mainly changes in separator geometry which should yield much better separation for impinging jet separators). Author

N74-14786*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DESIGN AND OPERATION OF A 1000 C LITHIUM-CESIUM TEST SYSTEM
L. G. Hays, G. M. Haskins, D. E. OConnor, and J. Torola, Jr. 1 Dec. 1973 149 p refs
(Contract NAS7-100)
(NASA-CR-136555; JPL-TM-33-633) Avail: NTIS HC $9.50 CSCL 10A

A 100 kWt cesium-lithium test loop fabricated of niobium-1% zirconium for experiments on erosion and two-phase system operation at temperatures of 980 C and velocities of 150 m/s. Although operated at design temperature for 100 hours, flow

instabilities in the two-phase separator interfered with the achievement of the desired mass flow rates. A modified separator was fabricated and installed in the loop to alleviate this problem. Author

N74-14787*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE DRIFT FIELD MODEL APPLIED TO THE LITHIUM-CONTAINING SILICON SOLAR CELL
Michael P. Godlewski, Cosmo R. Baraona, and Henry W. Brandhorst, Jr. 1973 9 p refs Presented at 10th Photovoltaic Specialists Conf., Palo Alto, Calif., 13-15 Nov. 1973; sponsored by IEEE
(NASA-TM-X-71489; E-7825) Avail: NTIS HC $3.00 CSCL 10A

The drift field model used by Wolf to calculate the short-circuit current was extended to permit calculations of the open-circuit voltage and the maximum power under conditions of illumination of either tungsten (2800 C) source or AMO sunlight. Voltages were calculated using an expression for the drift field diode saturation current derived here. The model, applied to the oxygen rich (C-13 group) lithium solar cells, was used to calculate the pre-and post-electron bombardment trends for lithium gradients in the range of 10 to the 18th power to 10 to the 19th power Li/cm to the 4th power. Published experimental data characterizing these cells were used to tailor the model. The calculated trends are in reasonable agreement with the empirical data of Faith. Diffusion length degradation and carrier removal effects were sufficient to predict the cell performance up to 3 x 10 to the 14th power e/sq cm. Beyond this fluence it was necessary to include drift field removal effects. Author

N74-14788*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE NASA-LEWIS TERRESTRIAL PHOTOVOLTAICS PROGRAM
Daniel T. Bernatowicz 1973 8 p refs Presented at 10th Photovoltaics Specialists Conf., Palo Alto, Calif., 13-15 Nov. 1973; sponsored by IEEE
(NASA-TM-X-71491; E-7828) Avail: NTIS HC $3.00 CSCL 10A

Research and technology efforts on solar cells and arrays having relevance to terrestrial uses are outline. These include raising cell efficiency, developing the FEP-covered module concept, and exploring low cost cell concepts. Solar cell-battery power systems for remote weather stations have been built to demonstrate the capabilities of solar cells for terrestrial applications. Author

N74-14789*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LOW-HIGH JUNCTION THEORY APPLIED TO SOLAR CELLS
Michael P. Godlewski, Cosmo R. Baraona, and Henry W. Brandhorst, Jr. 1973 14 p refs Presented at 10th Photovoltaic Specialists Conf., Palo Alto, Calif., 13-15 Nov. 1973; sponsored by IEEE
(NASA-TM-X-71492; E-7829) Avail: NTIS HC $3.00 CSCL 10A

Recent use of alloying techniques for rear contact formation has yielded a new kind of silicon solar cell, the back surface field (BSF) cell, with abnormally high open circuit voltage and improved radiation resistance. Several analytical models for open circuit voltage based on the reverse saturation current are formulated to explain these observations. The zero SRV case of the conventional cell model, the drift field model, and the low-high junction (LHJ) model can predict the experimental trends. The LHJ model applies the theory of the low-high junction and is considered to reflect a more realistic view of cell fabrication. This model can predict the experimental trends observed for BSF cells. Detailed descriptions and derivations for the models are included. The correspondences between them are discussed. This modeling suggests that the meaning of minority carrier diffusion length measured in BSF cells be reexamined. Author

N74-14790# European Space Research and Technology Center, Noordwijk (Netherlands).
DEVELOPMENT OF A HIGH-FREQUENCY dc/dc REGULATOR [DEVELOPPEMENT D'UN REGULATEUR C.C./C.C. HAUTE FREQUENCE]
A. Capel and C. Diolaiti Paris ESRO Jan. 1973 33 p refs In FRENCH; ENGLISH summary
(ESRO-TN-109-ESTEC) Avail: NTIS HC $3.75

The operation and electrical performance of a dc/dc regulator, forming the power supply subsystem for the GEOS project, was investigated with the object of evaluating the produced electromagnetic interference. The unit is of the pulse width modulation booster type (28 V within 1 % up to 60 kHz), and is capable of working at synchronization frequencies varying from 10 to 120 kHz, which is the electromagnetic interference EMI range to be investigated. Curves are presented which indicate the output as a function of the frequency, load, and input voltage. ESRO

N74-14791# Council on Environmental Quality, Washington, D.C.
ENERGY AND THE ENVIRONMENT: ELECTRIC POWER
Aug. 1973 66 p refs
(PB-223326/0GA) Avail: NTIS SOD HC $0.85 as 4111-00019 CSCL 13B

The conflict between energy needs and the environment poses a problem that must be solved by understanding the factors that influence demands for energy and by developing energy systems that meet these demands with minimal damage to the environment. This report considers the elements underlying our growing demand for energy and the environmental implications of the complex energy systems for meeting this demand. It focuses on electric energy because of the particularly rapid growth in this sector. GRA

N74-14792# Defense Documentation Center, Alexandria, Va.
BATTERIES Report Bibliography, Jan. 1967 - Apr. 1973
Oct. 1973 356 p refs
(AD-768500; DDC-TAS-73-59) Avail: NTIS CSCL 10/3

The bibliography is a selection of unclassified and unlimited citations on batteries. These references present information on design, cells, test, development, components, and performance characteristics. Discussed are many types of batteries, with most references relating to the nickel cadmium batteries and organic batteries. GRA

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N74-14793*+ George Washington Univ., Washington, D.C. Medical Center.
BIOMAGNETISM: A ANNOTATED BIBLIOGRAPHY Biological Sciences Communication Project
Louise A. Manganelli Feb. 1972 193 p refs
(Contract NSR-09-010-027)
(NASA-CR-136616; GW-BSCP-72-04R) Avail: NTIS HC $11.75 CSCL 06P

The bibliography consists of 161 annotated references on the subject of the biological effects of magnetic fields. The publications cited cover a period from 1967 through 1971. The references include research on plants, animals and humans exposed to field strengths ranging from null through geomagnetic, low, and high intensities. Variations in field orientation, exposure time and field gradient are noted where possible. Applications relevant to spaceflight are included; clinical observations and therapeutic applications are also noted. Author

N74-14794# Joint Publications Research Service, Arlington, Va.
SPACE BIOLOGY AND MEDICINE, VOLUME 7, NO. 6, 1973
18 Jan. 1974 127 p refs Transl. into ENGLISH of the periodical "Kosmicheskaya Biologiya i Meditsina, vol. 7, no. 6, 1973" Moscow, Med. Izd., Nov.-Dec. 1973 84 p
(JPRS-61020) Avail: NTIS

Biological and medical factors of the aerospace environment are considered with emphasis on radiation, acceleration, and

hypokinetic effects on man. For individual titles, see N74-14795 through N74-14812.

N74-14795 Joint Publications Research Service, Arlington, Va.
ANALYSIS OF THE RESULTS OF AN INVESTIGATION OF THE BIOLOGICAL EFFECT OF HEAVY IONS WITH DIFFERENT LINEAR ENERGY LOSSES ON THE BASIS OF A THEORETICAL INACTIVATION MODEL (INTERPRETATION OF EXPERIMENTS WITH E. COLI)
K. Guenther, Ye. A. Krasavin, Ye. I. Kudryashov, N. I. Ryzhov, and W. Schultz *In its* Space Biol. and Med., Vol. 7, No. 6, 1973 (JPRS-61020) 18 Jan. 1974 p 1-7 ref Transl. into ENGLISH of the periodical "Kosmicheskaya Biologiya i Meditsina, v. 7, no. 6, 1973" Moscow, Med. Izd., Nov.-Dec. 1973 p 3-8 (For availability see N74-14794 06-04)

The data obtained from experimental irradiation of E. coli with heavy ions having different linear energy losses, protons and gamma rays are analyzed from the point of view of a theoretical model of cell inactivation. It is indicated that using the model it is possible to determine the relative biological effectiveness of any radiation, including mixed types, and radiation modified by various factors when limited experimental data are available. Author

N74-14796 Joint Publications Research Service, Arlington, Va.
PHOTOBIOLOGICAL PROCESSES AND CRITERIA OF EXISTENCE OF LIVING SYSTEMS
A. B. Rubin *In its* Space Biol. and Med., Vol. 7, No. 6, 1973 (JPRS-61020) 18 Jan. 1974 p 8-14 refs Transl. into ENGLISH of the periodical "Kosmicheskaya Biologiya i Meditsina, v. 7, no. 6, 1973" Moscow, Med. Izd., Nov.-Dec. 1973 p 8-13 (For availability see N74-14794 06-04)

The role of light in the formation and evolution of living systems is discussed. It is concluded that the light flux is necessary for the support and development of life on the planet. Photobiological criteria for the existence of life are suggested. Author

N74-14797 Joint Publications Research Service, Arlington, Va.
MATHEMATICAL EVALUATION OF RELIABILITY OF FUNCTIONING OF THE BIOLOGICAL LINK IN A BIOENGINEERING SYSTEM **c05**
I. A. Shvytov *In its* Space Biol. and Med., Vol. 7, No. 6, 1973 (JPRS-61020) 18 Jan. 1974 p 15-20 refs Transl. into ENGLISH of the periodical "Kosmicheskaya Biologiya i Meditsina, v. 7, no. 6, 1973" Moscow, Med. Izd., Nov.-Dec. 1973 p 13-17 (For availability see N74-14794 06-04)

Reliability of the biological link in a bioengineering system is discussed. The use of an artificially cultivated microbial population is described. A criterion for assessing the reliability of functioning of the biological link is proposed. A method for computing the value of the criterion is formulated. Numerical calculations of the value of the reliability criterion are presented in relation to certain regimes in functioning of the biological link. Author

N74-14798 Joint Publications Research Service, Arlington, Va.
RESPIRATION OF POIKILOTHERMIC ANIMALS IN A HELIUM-OXYGEN ATMOSPHERE
Ye. B. Kanevskaya, A. B. Zimin, and P. V. Matekin *In its* Space Biol. and Med., Vol. 7, No. 6, 1973 (JPRS-61020) 18 Jan. 1974 p 21-23 refs Transl. into ENGLISH of the periodical "Kosmicheskaya Biologiya i Meditsina, v. 7, no. 6, 1973" Moscow, Med. Izd., Nov.-Dec. 1973 p 17-19 (For availability see N74-14794 06-04)

The Warburg manometric method was used in determining the oxygen consumption of Chyronomus plumosus L. larvae in the air and in a helium-oxygen atmosphere. The use of helium instead of nitrogen did not affect the gas exchange of Chyronomus larvae. This may be accounted for by a low temperature gradient between poikilothermic animals and the surrounding medium. Author

N74-14799 Joint Publications Research Service, Arlington, Va.
INFLUENCE OF NATURE OF DISTRIBUTION OF ABSORBED DOSE ON RADIATION DAMAGE **c05**
G. M. Avetisov, V. N. Budylin, V. G. Gorlov, and V. S. Grammatikati *In its* Space Biol. and Med., Vol. 7, No. 6, 1973 (JPRS-61020) 18 Jan. 1974 p 24-34 refs Transl. into ENGLISH of the periodical "Kosmicheskaya Biologiya i Meditsina, v. 7, no. 6, 1973" Moscow, Med. Izd., Nov.-Dec. 1973 p 19-26 (For availability see N74-14794 06-04)

The effect of damage by bilateral X-radiation of 7-8 keV and 12 keV was studied using 260 rats. The distribution of absorbed dosages in the animal body and in different radiosensitive organs was investigated. The contribution of the hemopoietic syndrome, the gastrointestinal syndrome and skin injuries to the total biological effect is discussed on the basis of a comparative examination of clincial manifestations of radiation damage as related to the distribution of the absorbed doses in the tissues and organs. Author

N74-14800 Joint Publications Research Service, Arlington, Va.
CHANGE IN INTENSITY OF ULTRAVIOLET FLUORESCENCE OF BLOOD LEUKOCYTES IN DOGS SUBJECTED TO CHRONIC IRRADIATION
S. N. Aleksandrov, V. G. Safronova, and A. S. Yagunov *In its* Space Biol. and Med., Vol. 7, No. 6, 1973 (JPRS-61020) 18 Jan. 1974 p 35-41 refs Transl. into ENGLISH of the periodical "Kosmicheskaya Biologiya i Meditsina, v. 7, no. 6, 1973" Moscow, Med. Izd., Nov.-Dec. 1973 p 27-31 (For availability see N74-14794 06-04)

The intensity of ultraviolet fluorescence of lymphocytes and neutrophils of dogs exposed to chronic gamma irradiation (at dose rates of 0.06, 0.17 and 0.34 rad/day) was studied. The intensity of UV fluorescence increased gradually at doses of 0 to 70 rad. The intensity remained at a constant level that was significantly higher than the control at doses of 70 to 300 rad. The intensity decreased with a further dose increase. It is suggested that the decline in the fluorescence level of blood leukocytes is associated with the appearance in the bone marrow of radioresistant cells producing leukocytes with a normal fluorescence intensity. This parameter was high at every dose tested (up to 740 rad) in the case of a combined effect of chronic irradiation and acute irradiation. Author

N74-14801 Joint Publications Research Service, Arlington, Va.
CYTOGENETIC INVESTIGATIONS OF BLOOD LEUKOCYTES CARRIED OUT WITH CREW MEMBERS OF THE SOYUZ SPACE SHIPS
N. N. Bobkova and T. N. Krupina *In its* Space Biol. and Med., Vol. 7, No. 6, 1973 (JPRS-61020) 18 Jan. 1974 p 42-47 refs Transl. into ENGLISH of the periodical "Kosmicheskaya Biologiya i Meditsina, v. 7, no. 6, 1973" Moscow, Med. Izd., Nov.-Dec. 1973 p 31-35 (For availability see N74-14794 06-04)

The results of cytogenetic investigations of ten crew members of Soyuz spacecraft before and after spaceflights are presented. Chromosomes were studied in a culture of peripheral leukocytes. No cytogenetic changes were noted on the first postflight day in comparison with the preflight data. Another examination carried out after three weeks of the postflight period exhibited no statistically significant differences in the frequency of structural aberrations of chromosomes in three cosmonauts in comparison with the preflight data. An aneuploidic analysis revealed 15-25% hypoploidal cells in one of the cosmonauts subjected to four investigations during three years. A karyotype analysis did not confirm the occurrence of mosaicism. Author

N74-14802 Joint Publications Research Service, Arlington, Va.
STUDY OF REACTIVITY OF BLOOD LYMPHOID CELLS IN CREW MEMBERS OF THE SOYUZ-6, SOYUZ-7 AND SOYUZ-8 SPACESHIPS BEFORE AND AFTER FLIGHT
I. V. Konstantinova, Ye. N. Antropova, V. I. Legenkov, and V. D. Zazhirey *In its* Space Biol. and Med., Vol. 7, No. 6, 1973 (JPRS-61020) 18 Jan. 1974 p 48-55 refs Transl. into ENGLISH of the periodical "Kosmicheskaya Biologiya i Meditsina, v. 7, no. 6, 1973" Moscow, Med. Izd., Nov.-Dec. 1973 p 35-40 (For availability see N74-14794 06-04)

Postflight examinations of five spaceship crew members revealed a decline in the radioactivity of immunocompetent lymphocytes (T-cells) of four cosmonauts. They revealed a delay in blatogenesis at the stage of transformation of small lymphocytes into PHA-cells. As a rule, the transformation delay was accompanied by an inhibition of the rate of RNA synthesis. The relationship which may exist between these changes and disturbances in the hormonal balance and changes in potassium and calcium metabolism is discussed. The conclusion is drawn

that the method of PHA blastoid transformation, which is a functional test indicating a state of the cell population that performs important functions in protecting the human body against infection, is very informative. Author

N74-14803 Joint Publications Research Service, Arlington, Va.
CHANGE IN IMMUNOLOGICAL REACTIONS IN HUMAN SUBJECTS UNDER THE INFLUENCE OF UNFAVORABLE MICROCLIMATIC CONDITIONS IN A PRESSURIZED CHAMBER

V. A. Kolotvin, R. Ye. Livshits, M. A. Nevstruyeva, S. I. Tarasov, and V. M. Shubik *In its* Space Biol. and Med., Vol. 7, No. 6, 1973 (JPRS-61020) 18 Jan. 1974 p 56-60 refs Transl. into ENGLISH of the periodical "Kosmicheskaya Biologiya i Meditsina, v. 7, no. 6, 1973" Moscow, Med. Izd., Nov.-Dec. 1973 p 40-43 (For availability see N74-14794 06-04)

Test subjects who lived in a pressurized chamber under conditions of an unfavorable climate, modified atmosphere and restricted diets were examined. Bactericidal activity, surface and deep skin automicroflora, titer of saliva lysozyme and the content of C-reactive protein were studied. The content of saliva lysozyme and skin bactericidal activity decreased or changed in a phaselike pattern. Humoral factors of nonspecific immunity changed insignificantly. Author

N74-14804 Joint Publications Research Service, Arlington, Va.
CHANGE IN THE EXTERNAL RESPIRATION FUNCTION DURING MOTION SICKNESS

V. K. Stepanov, I. A. Sidelnikov, and G. I. Pavlov *In its* Space Biol. and Med., Vol. 7, No. 6, 1973 (JPRS-61020) 18 Jan. 1974 p 61-65 refs Transl. into ENGLISH of the periodical "Kosmicheskaya Biologiya i Meditsina, v. 7, no. 6, 1973" Moscow, Med. Izd., Nov.-Dec. 1973 p 44-47 (For availability see N74-14794 06-04)

Changes in the external respiration function of subjects with various vestibular tolerances to Coriolis accelerations were studied. Among them there were 12 intolerant subjects (fourth degree), 14 with moderate vestibular tolerance (third-second degree) and five with a high tolerance (first degree). All the test subjects were exposed to Coriolis accelerations which were continuously accumulated. Persons with a high tolerance to Coriolis accelerations exhibited no significant changes in external respiration during the exposure. Intolerant subjects exhibited hyperventilation which led to a slight decrease in PACO2. Changes in external respiration parameters may serve as an additional index of the vestibular tolerance level. Author

N74-14805 Joint Publications Research Service, Arlington, Va.
INFLUENCE OF TRANSVERSE ACCELERATIONS ON THE ACTIVITY OF HUMAN SERUM CHOLINESTERASE

Ye. M. Semina and I. D. Vertanov *In its* Space Biol. and Med., Vol. 7, No. 6, 1973 (JPRS-61020) 18 Jan. 1974 p 66-71 refs Transl. into ENGLISH of the periodical "Kosmicheskaya Biologiya i Meditsina, v. 7, no. 6, 1973" Moscow, Med. Izd., Nov.-Dec. 1973 p 47-51 (For availability see N74-14794 06-04)

The activity of serum cholinesterase of man exposed to back-to-chest accelerations imparted at an angle of 78 to the longitudinal axis of the body was evaluated. Enzyme activity increased during an exposure up to 8 g (imparted for 60 sec), remained unchanged during an exposure to 10 g and 12 g (imparted for 60 and 35 sec respectively), and decreased during exposure to 14 g (imparted for 20 sec). The results obtained suggest that the effect of back-to-chest accelerations of 8 g for 60 sec enhances the liver proteosynthetic function. The reason for the decrease in cholinesterase activity during exposure to accelerations of 14 g for 20 sec remains obscure. Author

N74-14806 Joint Publications Research Service, Arlington, Va.
EFFECT OF VESTIBULAR TESTS ON ORIENTATION RELATIVE TO THE VERTICAL IN HEALTHY AND DEAF-MUTE SUBJECTS

B. B. Bokhov, I. Ya. Yakovlev, L. N. Kornilova, A. A. Guyev, A. A. Kravchenko, and V. A. Ryabichev *In its* Space Biol. and Med., Vol. 7, No. 6, 1973 (JPRS-61020) 18 Jan. 1974 p 72-79 refs Transl. into ENGLISH of the periodical "Kosmicheskaya Biologiya i Meditsina, v. 7, no. 6, 1973" Moscow, Med. Izd., Nov.-Dec. 1973 p 51-56 (For availability see N74-14794 06-04)

The influence of expert tests -- swinging in swings and rotation with tilts -- on the capability of healthy and deaf-mute subjects to determine position of the gravitational vertical was studied by using an instrument with a rotating luminescent line. The results of an investigation of healthy test subjects revealed that swinging causes more clearly expressed shifts in perception correlating with autonomic reactions than rotation with tilts, after which such correlation was not observed. In deaf-mute subjects after rotation with tilts there were no shifts in perception, even if rotation was accompained by autonomic reactions. Author

N74-14807 Joint Publications Research Service, Arlington, Va.
DETERMINING EXCESS PRESSURE ON THE LOWER PART OF THE BODY ENSURING PREVENTION OF ORTHOSTATIC IMPAIRMENTS

B. F. Asyamolov, V. S. Panchenko, I. D. Pestov, and M. A. Tikhonov *In its* space Biol. and Med., Vol. 7, No. 6, 1973 (JPRS-61020) 18 Jan. 1974 p 80-87 refs Transl. into ENGLISH of the periodical "Kosmicheskaya Biologiya i Meditsina, v. 7, no. 6, 1973" Moscow, Med. Izd., Nov.-Dec. 1973 p 56-61 (For availability see N74-14794 06-04)

Lower body positive pressure applied by means of an antigravity suit decreased orthostatic reactions of test subjects exposed to simulated weightlessness (18-hour water immersion, 30-day bed rest). Lower body positive pressure of 50 and 35 mm Hg proved to be effective and well tolerated whereas that of 20 mm Hg proved to be inadequate for preventing orthostatic disturbances. The greatest effect in the prevention of orthostatic disturbances was achieved by a combination of different countermeasures. Author

N74-14808 Joint Publications Research Service, Arlington, Va.
ORTHOSTATIC STABILITY IN AN EXPERIMENT WITH 30-DAY HYPODYNAMIA

V. S. Georgiyevskiy, V. A. Gornago, L. Ya. Divina, N. D. Kalmykova, V. M. Mikhaylov, V. I. Plakhatnyuk, Yu. D. Pometov, V. V. Smyshlyayeva, N. D. Vikharev, and B. S. Katkovskiy *In its* Space Biol. and Med., Vol. 7, No. 6, 1973 (JPRS-61020) 18 Jan. 1974 p 88-97 refs Transl. into ENGLISH of the periodical "Kosmicheskaya Biologiya i Meditsina, v. 7, no. 6, 1973" Moscow, Med. Izd., Nov.-Dec. 1973 p 61-68 (For availability see N74-14794 06-04)

Nine test subjects were kept for 30 days in bed with their heads tilted 4 deg downwards. At the end of the experiment they exhibited a decrease in orthostatic stability. The use of different countermeasures, including physical exercises and lower body negative pressure (LBNP), considerably improved their orthostatic stability. Electric stimulation of the muscles also produced a preventive effect, although to a lesser extent. It should be expected that a combination of physical exercises, LBNP and electric stimulation of the muscles during prolonged space flight may exert a positive effect on orthostatic stability. Author

N74-14809 Joint Publications Research Service, Arlington, Va.
COMPARATIVE INVESTIGATIONS OF TEMPERATURE IN DIFFERENT REGIONS OF THE HUMAN BODY DURING BODY OVERHEATING

A. N. Azhayev and D. G. Maksimov *In its* Space Biol. and Med., Vol. 7, No. 6, 1973 (JPRS-61020) 18 Jan. 1974 p 98-103 refs Transl. into ENGLISH of the periodical "Kosmicheskaya Biologiya i Meditsina, v. 7, no. 6, 1973" Moscow, Med. Izd., Nov.-Dec. 1973 p 68-72 (For availability see N74-14794 06-04)

Comparative studies of body temperature in the rectum, mouth, armpits and on the head (behind the ears) revealed that at a high ambient temperature and with overheating of the human body temperature measurements of the thermally insulated area of the head surface clearly indicated overheating of the subject. The difference in the head and rectal temperatures decreased substantially (to 0.15-0.20 C) under these conditions. Accordingly, normal methods for evaluating head temperature are applicable. Temperature measurement in the head area has advantages over measurement in other parts of the body because it appears to be simple and reliable during occupational activities. Author

N74-14810 Joint Publications Research Service, Arlington, Va.
MINERALIZATION OF HUMAN BONE TISSUE UNDER

WATER IMMERSION CONDITIONS (ROENTGENOPHOTOMETRIC INVESTIGATION)
K. I. Murakhovskiy and L. Z. Golod *In its* Space Biol. and Med., Vol. 7, No. 6, 1973 (JPRS-61020) 18 Jan. 1974 p 104-108 refs Transl. into ENGLISH of the periodical "Kosmicheskaya Biologiya i Meditsina, v. 7, no. 6, 1973" Moscow, Med. Izd., Nov.-Dec. 1973 p 72-75 (For availability see N74-14794 06-04)

The effect of five day water immersion on the mineral content of bones was studied in subjects when wearing and not wearing a prophylactic load suit. The bone mineral content was measured roentgenophotometrically in milligrams of Ca per 1 cu mm before and on the second day of immersion. The objects studied were the navicular bone, ankle bone, heel bone, distal metadiaphysis of the hip bone and proximal metadiaphysis of the tibia. In experiments without the suit the level of bone density in the studied areas decreased by 4-8%. Statistical analysis revealed that the decrease was significant with $P = 0.95$. A comparison of the significance of the differences between bone density changes in experiments with and without the suit demonstrated that they are statistically significant for the navicular bone, ankle bone and heel bone and not significant for the tubular bones.
Author

N74-14811 Joint Publications Research Service, Arlington, Va.
WAYS TO INCREASE THE NOISE IMMUNITY OF A SYSTEM FOR REGISTERING THE BIOELECTRIC POTENTIALS OF MAN UNDER THE INFLUENCE OF PROLONGED ACCELERATIONS
L. N. Nikolskiy *In its* Space Biol. and Med., Vol. 7, No. 6, 1973 (JPRS-61020) 18 Jan. 1974 p 109-117 refs Transl. into ENGLISH of the periodical "Kosmicheskaya Biologiya i Meditsina, v. 7, no. 6, 1973" Moscow, Med. Izd., Nov.-Dec. 1973 p 75-81 (For availability see N74-14794 06-04)

The nature of the specific interference arising under experimental conditions on acceleration stands during the registry of electric potentials of the heart, brain and skeletal muscles in man and the effectiveness of some protective measures are studied. Analysis of the conditions for registry of biopotentials and the results of special investigations of the nature of the interference and the experimental data (EKG, EEG, EMG), obtained in investigations with acceleration stands (centrifuges of different radii, vibration stands, stands for imparting sign-variable accelerations and angular accelerations), made it possible to detect the principal types of interference and described their characteristics.
Author

N74-14812 Joint Publications Research Service, Arlington, Va.
ROLE OF CEREBELLUM IN VESTIBULAR-CARDIAC REACTIONS DURING MOTION SICKNESS IN LOWER MONKEYS
A. S. Markin *In its* Space Biol. and Med., Vol. 7, No. 6, 1973 (JPRS-61020) 18 Jan. 1974 p 118-121 refs Transl. into ENGLISH of the periodical "Kosmicheskaya Biologiya i Meditsina, v. 7, no. 6, 1973" Moscow, Med. Izd., Nov.-Dec. 1973 p 82-84 (For availability see N74-14794 06-04)

Changes in pulse rate at the time of motion sickness were studied with electric stimulation of some structural formations in the cerebellum in monkeys. Results show that stimulation of the cortex and nuclei of the cerebellum during prolonged swinging of the monkeys and at the time immediately following motion in swings, were in reciprocal relationships to the effect on cardiac reflex activity.
Author

N74-14813*# National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.
REGULATORY BIOLOGY: DEPRESSED METABOLIC STATES
Emily Morey Holton, ed Aug. 1973 181 p refs Symp. held at Wallops Island, Va., 18-20 Oct. 1971
(NASA-TM-X-69354) Avail: NTIS HC $11.25 CSCL 06P

Exobiological aspects of depressed metabolism and thermoregulation are discussed for subsequent development of biological space flight experiments. Included is a brief description of differential hypothermia in cancer chemotherapy. For individual titles, see N74-14814 through N74-14822.

N74-14814* National Aeronautics and Space Administration, Washington, D.C.
THE ROLE OF DEPRESSED METABOLISM IN SPACE BIOLOGY: AN OVERVIEW
Joseph Saunders *In its* Regulatory Biol.: Depressed Metab. Aug. 1973 p 1-22 (For availability see N74-14813 06-04)
CSCL 06P

Organization and research activities of the entire NASA Space Biology Program are outlined. Various technical approaches are reported to study depressed metabolism particularly in the situation of 100% oxygen and reduced ambient pressures. These include hibernation and hypothermia, thermal regulation, and diluent gases.
G.G.

N74-14815* National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.
WALLOPS AND ITS ROLE IN DEPRESSED METABOLISM
c11
Emily M. Holton *In its* Regulatory Biol.: Depressed Metab. Aug. 1973 p 23-26 (For availability see N74-14813 06-04)
CSCL 14B

Facilities and organization at the Wallops station are reviewed and some current research work is described that pertains to noise abatement studies as well as some testing phases on V/STOL aircraft. Radiation biology results of various space flights are reviewed and some efforts for the Regulatory Biology Program, involving depressed metabolism aspects of space travel are detailed.
G.G.

N74-14816* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EFFECT OF ARTIFICIAL GRAVITY ON THERMOREGULATION, RESPIRATORY METABOLISM AND INTERMEDIARY METABOLISM OF ANIMALS
Jiro Oyama *In its* Regulatory Biol.: Depressed Metab. Aug. 1973 p 27-51 refs (For availability see N74-14813 06-04)
CSCL 06P

Metabolic alterations in animals exposed to radial acceleration are reported. Temperatures in acutely stressed animals dropped profoundly in correlation with decreased food consumption. Repeated exposure of the acutely stressed animal caused a decrease in hypothermic response whereas deceleration or reduction of G load did not significantly change body temperatures. Adrenal corticosteroids affected signicantly the animal's recovery rate. No changes occured in body temperature patterns of chronically centrifuged animals after full adaptaion; their respiratory rate increased very significantly in terms of CO_2 output as did their glucose uptake by muscle tissues and their insulin responsiveness or sensitivity.
G.G.

N74-14817* Colorado State Univ., Fort Collins.
METABOLIC EFFECTS OF ARTIFICIAL ENVIRONMENTS
John Patrick Jordan *In* NASA. Wallops Station Regulatory Biol.: Depressed Metab. Aug. 1973 p 52-72 refs (For availability see N74-14813 06-04)
CSCL 06P

Effects of diluent gases on the metabolism of animals breathing nitrogen-oxygen, argon-oxygen, and helium-oxygen mixtures were studied. Results show that helium actually affected the mean free path of oxygen across the alveoli and increased metabolic rate. It is speculated that it might be necessary to keep an astronaut in a depressed metabolic state during prolonged space flight by using an argon-oxygen or a xenon-nitrogen mixture for breathing. Replacement of the depressant gases during periods requiring critical spacecraft maneuvers by neon-oxygen mixtures would insure maximal performance.
G.G.

N74-14818* Missouri Univ., Columbia. Space Sciences Research Center.
HIBERNATION, SLEEP, AND THERMOREGULATION
Frank E. South *In* NASA. Wallops Station Regulatory Biol.: Depressed Metab. Aug. 1973 p 73-90 refs (For availability see N74-14813 06-04)
CSCL 06P

Nerve activity adaptation to hypothermia and the differences in CNS activity during hypothermia are studied on marmots. Thermoregulatory experiments on hibernating animals indicated a sympathetic response.
G.G.

N74-14819* Missouri Univ., Columbia. Space Sciences Research Center.
RADIOPROTECTION IN DEPRESSED METABOLIC STATES: THE PHYSIOLOGY OF HELIUM-COLD HYPOTHERMIA
X. J. Musacchia *In* NASA. Wallops Station Regulatory Biol.: Depressed Metab. Aug. 1973 p 91-118 refs (For availability see N74-14813 06-04)
CSCL 06S

The use of hypothermia as a means of radiation protection was studied on a variety of mammals exposed to 80% helium-20% oxygen atmospheres at low ambient temperatures. Results show that the LD for normothermic animals significantly increased compared with hypothermic animals; similar results were obtained for hibernating mammalians. Pre-exposure of animals to cold temperatures increased their ability to withstand radiation levels close to LD sub 50. G.G.

N74-14820* Institute for Lipid Research, Berkeley, Calif.
INTERMEDIARY METABOLISM DURING BRIEF AND PROLONGED LOW TISSUE TEMPERATURE
Cecil Enteman *In* NASA. Wallops Station Regulatory Biol.: Depressed Metab. Aug. 1973 p 119-138 refs (For availability see N74-14813 06-04)
CSCL 06S

The intermediary metabolism of the depressed metabolic state in the hypothermic hamster and the hibernating ground squirrel was studied by observing acetate and palmitic acid metabolisms in their tissues. The oxidative metabolism seemed to be dominant in the depressed state although synthetic reactions such as fat synthesis proceeded in some cases at a faster rate than normothermic metabolism for the same tissues. Fat syntheses proceeded in all tissues with brown fat and liver especially active. Enzymes for the synthesis of cholesterol seemed to be more temperature sensitive than enzymes for fatty acid synthesis. It was concluded that there are no great differences between metabolisms in hypothermic and hibernating animals. Author

N74-14821* California Univ., Davis. School of Veterinary Medicine.
THE ROLE OF BROWN ADIPOSE TISSUE IN TEMPERATURE REGULATION
Robert Em. Smith *In* NASA. Wallops Station Regulatory Biol.: Depressed Metab. Aug. 1973 p 139-157 refs (For availability see N74-14813 06-04)
CSCL 06P

The thermogenetic capacities of brown adipose tissue were studied on marmots, rats and monkeys in response to cold exposure. All experiments indicated that the brown fat produced heat and slowed the cooling of tissues. G.G.

N74-14822* Emory Univ., Atlanta, Ga. Medical School.
METHODS FOR STUDY OF CARDIOVASCULAR ADAPTATION OF SMALL LABORATORY ANIMALS DURING EXPOSURE TO ALTERED GRAVITY
Vojin Popovic *In* NASA. Wallops Station Regulatory Biol.: Depressed Metab. Aug. 1973 p 158-177 refs (For availability see N74-14813 06-04)
CSCL 06P

Several new techniques are reported for studying cardiovascular circulation in small laboratory animals kept in metabolic chambers. Chronical cannulation, miniaturized membrane type heart-lung machines, a prototype walking chamber, and a fluorocarbon immersion method to simulate weightlessness are outlined. Differential hypothermia work on rat cancers provides localized embedding of radionuclides and other chemotherapeutical agents in tumors and increases at the same time blood circulation through the warmed tumor as compared to the rest of the cold body. Some successful clinical applications of combined chemotherapy and differential hypothermia in skin cancer, mammary tumors, and brain gliomas are described. G.G.

N74-14823*# Kanner (Leo) Associates, Redwood City, Calif.
PROBLEMS OF SPACE BIOLOGY. VOLUME 20. MATHEMATICAL MODELS OF BIOLOGICAL SYSTEMS
Yu. M. Svirezhev and Ye. Ya. Yelizarov Washington NASA Nov. 1973 185 p refs Transl. into ENGLISH of the book "Problemy Kosmicheskoy Biologii. Tom 20: Matematicheskoye Modelirovaniye Biologicheskikh Sistem" Moscow, Nauka, 1972 160 p
(Contract NASw-2481)
(NASA-TT-F-780) Avail: NTIS HC $5.25 CSCL 06F

Well-known mathematical models are used to model population associations, biocoenoses, biogeocoenoses and artificial biological associations. The optimal yield concept is defined in relation to the optimal productivity of an association. The optimal productivity problem is solved for the simplest types of associations, such as a homogeneous population in a chemostat and also in more complex cases, for example, for an association of the predator-prey type. The simplest models are generalized to cases in which it is necessary to take into consideration the distribution of individuals in the population by age, size, etc. The models are described by systems of differential equations. The optimal policies are obtained using dynamic programming methods, nonlinear programming methods and the Pontryagin maximum principle. Optimal steady state strategies are also obtained. Author

N74-14824*# Naval Aerospace Medical Research Lab., Pensacola, Fla.
THE VALUE OF EXERCISE AT ONE-HALF EARTH GRAVITY IN PREVENTING ADAPTATION TO SIMULATED WEIGHTLESSNESS
John Hoche and Ashton Graybiel 25 Jun. 1973 23 p refs (NASA Order T-5904-B)
(NASA-CR-136569; AD-767646; NAMRL-1191) Avail: NTIS HC $3.25 CSCL 06/14

Twelve male subjects participated in two identical series to determine the value of exercising four hours daily at one-half earth gravity (simulated) to prevent loss of exercise capacity and orthostatic tolerance when exposed to 14 days of simulated weightlessness. In one series four subjects exercised at half-gravity (HGE subjects) on treadmills mounted in a human centrifuge and four exercised on treadmills mounted on inclined planes; in the other series the subjects switched exercise devices. Four subjects served as no-exercise controls throughout both series. Additional measurements included: plasma volume and red cell mass, urinary sodium and potassium, and peripheral renin activity. The results are discussed in terms of their significance for long-range plans involving the use of artificial gravity as a countermeasure on space missions. (Modified author abstract) GRA

N74-14825*# Scripta Publishing Corp., Washington, D.C.
THE EFFECT OF PHYSICAL EXERCISE ON BINDING OF CORTICOSTEROIDS BY TRANSCORTIN IN PLASMA
A. F. Bunyatyan and V. P. Erez NASA Jan. 1974 10 p refs Transl. into ENGLISH from Prob. Endok. (Moscow), v. 18, 1972 p 13-17
(Contract NASw-2484)
(NASA-TT-F-15258) Avail: NTIS HC $3.00 CSCL 06S

The content of protein-bound and free forms of 11-OCS, and also the binding capacity of transcortin were examined in 11 healthy highly-qualified athletes who were in condition of chronic physical overexertion during the examination; 12 healthy untrained men were also observed (control group). Determinations were made in the state of rest and during four-day veloergometric exercises. During rest the processes of steroid-protein interaction in healthy athletes coursed normally; this caused a considerable prevalence of transcortin-bound fraction over the free form of the hormones. During maximal physical exertion healthy athletes displayed a reduction of transcortin-binding capacity in vitro, to the level of protein-bound corticosteroids in the blood of persons investigated. Possible mechanisms involved in development of the mentioned changes are discussed. Author

N74-14826*# Kanner (Leo) Associates, Redwood City, Calif.
EFFECT OF PROLONGED HYPOKINESIA ON CERTAIN FUNCTIONS OF THE OTORHINOLARYNGOLOGICAL ORGANS
I. Ya. Yakovlev, V. P. Baranov, and E. I. Matsnev Washington NASA Jan. 1974 17 p refs Transl. into ENGLISH from Vestn. Otorinolaringol. (Moscow), v. 6, no. 6, 1967 p 45-51
(Contract NASw-2481)
(NASA-TT-F-15275) Avail: NTIS HC $3.00 CSCL 06S

The functional state of otorhinolaryngological organs was studied in six persons in restricted mobility for a period of 62

days. The occurrence of otorhinolaryngological morbidity was noted on the second month of restricted mobility (tonsillitis, catarrh of the upper respiratory tract, acute pharyngitis, nasal bleeding). The subjects revealed circulatory disturbances in the nasal mucous membrane, increased dystrophy of the mucous membranes of the upper respiratory tract, reduced auditory sensitivity, and vestibulo-autonomic resistance. All the changes have an undulant dynamics and a period of sequelae. It is concluded that they were caused, to a certain degree, by hemodynamic shifts and general asthenia. Author

N74-14827*# Kanner (Leo) Associates, Redwood City, Calif.
DRUG METABOLISM AND FOREIGN MATTER HYDROXYLASE (CYTOCHROME P-450) IN SEVERE HEPATIC DAMAGE IN MAN
H. F. VonOldershausen, B. Schoene, H. Held, H. P. Menz, R. A. Fleischmann, and H. Remmer Washington NASA Jan. 1974 11 p refs Transl. into ENGLISH from Z. Gastroenterol. (West Ger.), v. 11, 1973 p 403-410
(Contract NASw-2481)
(NASA-TT-F-15276) Avail: NTIS HC $3.00 CSCL 06E

In cases of severe hepatic damage (acute hepatitis, active hepatic cirrhosis), a significant reduction is found in the level of cytochrome P 450, in N and O demethylation, and in the activities of pseudocholinesterase and glucose-6-phosphate in human liver biopsy homogenates. Induction of cytochrome P 450, cytochrome C reductase and O demethylation is detected in liver homogenate after the administration of Rifampicin, Chlortritylimidazol or diphenylhydantoin and phenobarbital. The elimination of Rifampicin from the blood is markedly delayed in patients with acute hepatitis or hepatic cirrhosis. Half-life or tolbutamide significantly shortened in acute hepatitis; close correlation in vitro between bilirubin concentration and percentage of free tolbutamide. These findings illustrate the dependence of drug metabolism upon the concentration of microsomal enzyme systems in the liver. Author

N74-14828*# Kanner (Leo) Associates, Redwood City, Calif.
STUDY OF VENOUS TONUS IN THE FOREARM DURING SIMULATED WEIGHTLESSNESS
D. Kaiser and O. H. Gauer Washington NASA Jan. 1974 3 p refs Transl. into ENGLISH from Pflugers Arch. (West Ger.), v. 289, 1966 p R76-77
(Contract NASw-2481)
(NASA-TT-F-15228) Avail: NTIS HC $3.00 CSCL 06P

A reduction in venous tonus, assumed to be partly a function of temperature, is observed directly after immersion in a thermally neutral bath. Several hours of immersion causes further relaxation of veins. Author

N74-14829*# Kanner (Leo) Associates, Redwood City, Calif.
WATER AND SALINE BALANCES DURING PROLONGED IMMERSION IN A WATER BATH
P. Eckert, C. Behn, O. H. Gauer, and K. Kirsch Washington NASA Jan. 1974 3 p refs Transl. into ENGLISH from Pflugers Arch. (West Ger.), v. 297, 1967 p R70-71
(Contract NASw-2481)
(NASA-TT-F-15229) Avail: NTIS HC $3.00 CSCL 06P

Water and electrolyte elimination were studied during 48 hours' immersion. Initial water diuresis, increased hematocrit values, and increased plasma protein were observed. Results show that these processes sometimes failed to return to the normal levels during the immersion period. Author

N74-14830*# Kanner (Leo) Associates, Redwood City, Calif.
THE EFFERENT INNERVATION OF THE VESTIBULAR RECEPTORS
G. Rossi Washington NASA Jan. 1974 15 p refs Transl. into ENGLISH from Acta Oto-Laryngol (Uppsala), V. 58, 1964 p 230-238
(Contract NASw-2481)
(NASA-TT-F-15231) Avail: NTIS HC $3.00 CSCL 06P

The efferent innervation of the vestibular receptors is discussed in the light of current literature and personal experimental findings. Recent studies are reviewed which have demonstrated that nerve fibers subject to actylcholine sterase activity exist in the acoustic crests and otolithic membranes and that these are efferent fibers. The research is based on the fact that the cochlear efferent fibers forming the intraganglionic spiral tract can be distinguished from the afferent fibers by the positivity of the former to an acetylcholine sterase reaction. Attempts are made to find whether this difference also applies to the vestibular efferent fibers and the afferent fibers. Author

N74-14831*# Exotech Systems, Inc., Falls Church, Va.
SCIENTIFIC AND TECHNICAL SERVICES DIRECTED TOWARD THE DEVELOPMENT OF PLANETARY QUARANTINE MEASURES FOR AUTOMATED SPACECRAFT
Quarterly Report, period ending 31 Dec. 1973
7 Jan. 1974 6 p
(Contract NASw-2503)
(NASA-CR-136613; QR-3) Avail: NTIS HC $3.00 CSCL 06M

The research is briefly reported for each task area of the planetary quarantine program. Author

N74-14832*# Techtran Corp., Glen Burnie, Md.
CERTAIN RESULTS OF THE MEDICO-BIOLOGICAL INVESTIGATION CONDUCTED IN THE GEMINI AND APOLLO PROGRAMS: CHANGE IN WEIGHT AND INDICES OF THE CARDIOVASCULAR SYSTEM IN ASTRONAUTS
V. I. Kopanev and Ye. M. Yuganov Washington NASA Jan. 1974 28 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Biol. (Moscow), no. 5, 1973 p 629-646
(Contract NASw-2037)
(NASA-TT-F-15261) Avail: NTIS HC $3.50 CSCL 06P

It was found that the weight of the astronauts decreased during flight and was rapidly restored afterward (1 to 2 days). The mechanism of these changes is governed primarily by phenomena associated with dehydration of the organism. During postflight examination of the astronauts, a decrease in the orthostatic stability was observed as the result of the action of weightlessness. Following flights on which astronauts landed on the moon, there was less evidence of orthostatic disturbances. The changes that were observed involving the cardiovascular system constituted accommodative reactions to unusual spaceflight conditions. Author

N74-14833*# Techtran Corp., Glen Burnie, Md.
MEASUREMENT OF THE STROKE VOLUME BY AN INTEGRAL RHEOGRAM OF THE HUMAN BODY
M. I. Tishchenko Washington NASA Jan. 1974 16 p refs Transl. into ENGLISH from Fiziol. Zh. SSSR (Moscow), v. 59, no. 8, Aug. 1973 p 1216-1224
(Contract NASw-2485)
(NASA-TT-F-15268) Avail: NTIS HC $3.00

Two electrically short-circuited electrodes are applied to the distal areas of the forearm and two electrodes connected in the same fashion are applied to the distal areas of the shins. When the measuring arm of a bridge rheograph is connected between the paired electrodes of the upper and lower extremities, a curve is recorded which is the integral rheogram of the body. This curve reflects the total pulse variation of the electrical resistance of the vessels that are located between the electrodes and is caused primarily by the pulse variations in the volume of the large longitudinal arterial trunks. A formula was worked out to calculate the stroke volume of the left ventricle according to the anacrotic part of the integral rheogram. Data were obtained that are in agreement with the acetylene method, the method of thermodilution and the direct Fick method. The possibility of measuring the stroke volume for each cardiac contraction was established. Author

N74-14834*# Techtran Corp., Glen Burnie, Md.
SOME RESULTS OF BIOMEDICAL INVESTIGATIONS CONDUCTED DURING THE GEMINI AND APOLLO PROGRAMS (ALTERATIONS IN BLOOD AND SKELETAL APPARATUS, MINERAL AND ELECTROLYTE METABOLISM IN THE ASTRONAUTS)
V. I. Kopanev and Ye. M. Yuganov Washington NASA Jan. 1974 18 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Biol. (Moscow), no. 6, Nov. - Dec. 1973 p 852-863
(Contract NASw-2485)
(NASA-TT-F-15270) Avail: NTIS HC $3.00 CSCL 06S

It was found that in the course of postflight examinations individual astronauts showed certain changes involving the blood

(decrease in erythrocyte mass, leucocytosis and so forth), skeletal structure (decrease in bone density), and mineral and electrolyte metabolism (washing out of calcium, iron, potassium and chloride). Author

N74-14835# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany). Inst. fuer Flugmedizin.

QUALITATIVE IDENTIFICATION OF ORAL EFFECTIVE ANTIDIABETICA IN BLOOD SERUM OF HUMANS [QUALITATIVER NACHWEIS ORAL WIRKSAMER ANTIDIABETICA IM BLUTSERUM DES MENSCHEN]

Gerhard Schaefer Porz, West Ger. 6 Jul. 1973 30 p refs In GERMAN; ENGLISH summary

(DLR-FB-73-88) Avail: NTIS HC $3.50; DFVLR, Porz, West Ger. 11,80 DM

For the medical evaluation of flying fitness in a latent diabetic and in order to control the observance of the regulation that no blood sugar depressing substances be taken by flying personnel, analytical procedures have to be developed by which all (known) oral effective antidiabetica in the blood (and, possibly, in the urine) can be estimated. The particular difficulty of a routine series analysis consists in the fact that these substances belong to different chemical classes of substances and, futhermore, are therapeutically active in extremely different doses. The pyrimidyl sulfonamide glycodiacine and the sulfoacid carbacide carbutamide, chlorpropamide and tolbutamide can be separated by thin layer chromatography to a great extent and can be estimated by their fluorescence or by their fluorescence quenching properties and by their color reactions. The identification of glibenclamide and glibornuride can probably be done spectrofluorometrically with a 5 ml sample of blood serum. The biguanides which can also fluorometrically be identified are rapidly eliminated in the urine so that spectrophotometrically the identification in urine seems suitable. Author (ESRO)

N74-14836# Human Factors Research, Inc., Goleta, Calif.

MOTION SICKNESS INCIDENCE AS A FUNCTION OF THE FREQUENCY AND ACCELERATION OF VERTICAL SINUSOIDAL MOTION Technical Report, 1 Jul. 1972 - 30 Jun. 1973

James F. Hanlon and Michael E. McCauley Sep. 1973 22 p refs

(Contract N00014-73-C-0040; NR Proj. 105-661)

(AD-768215; Rept-1733-1) Avail: NTIS CSCL 06/19

Fourteen experimental conditions of vertical sinusoidal motion were defined by combinations of wave frequency and acceleration level in a partial factorial design. The frequency range investigated was from 5 cycles per minute (CPM, or .083 Hz) to 30 CPM (.500 Hz), and the average acceleration over each half-wave cycle ranged from about .03 to .40 g. Independent groups of 20 or more male Ss were exposed for 2 hours or until they began to vomit, whichever came first. Motion sickness incidence (MSI), defined as the percentage of Ss experiencing vomiting, was greatest at a frequency of 10 CPM (.167 Hz). For all wave frequencies, MSI increased as a monotonic function of the acceleration level. A mathematical model was derived from the data, and the implications for underlying physiological mechanisms and for transportation vehicle design were discussed. Author (GRA)

N74-14837# Naval Air Development Center, Warminster, Pa. Crew Systems Dept.

DETECTION OF SHORT DURATION LIGHT SIGNALS PRESENTED IN THE PERIPHERY Progress Report

Robert M. Herrick 22 May 1973 26 p refs

(AD-767320; NADC-73115-40) Avail: NTIS CSCL 06/16

While viewing the terrain or some visual display device, naval personnel must attend to signals presented in the periphery. Whether such signals are detected depends upon the luminance of the signals, the duration of the signals, the interval of time separating successive signals, and the number of signals presented. These four visual variables were examined, in psychophysical experiments, and simple empirical laws were derived to describe the relations among the variables. (Modified author abstract) GRA

N74-14838# Naval Air Development Center, Warminster, Pa. Crew Systems Dept.

ANALYSIS OF HEAD IMPACT Interim Report

Stephen L. Gordon 1 May 1974 136 p refs

(AD-767319; NADC-73065-40) Avail: NTIS CSCL 06/19

A finite difference form of the governing equations of motion for one and two-dimensional wave propagation is utilized to solve the problem of non-penetrating impact to the human head. The layered plate one-dimensional analysis provides a method of predicting the influence of several material property and size modifications in a geometrically simplified head impact model. The spherical model with a layered energy absorbing skull yields highly attenuated and smoothed tensile pressure peaks in the brain as compared to the results with a single layered elastic skull. An elastic brain model (that includes an assumed high dynamic shear modulus) suggests that the combined shear-normal stress levels would be more likely to cause failure than the shear free stress condition in a hydrodynamic brain model. The generality of the solution techniques would readily permit extension of the analyses to investigate the significance of future modelling considerations. Author (GRA)

N74-14839# Naval Air Development Center, Warminster, Pa. Crew Systems Dept.

OPTICAL EFFECTS OF PIGMENTATION OF TEMPERATURE RISE IN A TWO-LAYER SKIN SIMULANT SYSTEM DURING IRRADIATION Interim Report

John R. Piergallini and Alice M. Stoll 31 Oct. 1972 51 p refs

(AD-767649; NADC-72225-CS) Avail: NTIS CSCL 06/16

It is demonstrated that from a knowledge of the thermal and optical properties of each layer of a two-layer system, together with the amplitude and distribution of the energy input, it is possible to predict temperature rises at depth in the second layer of a two-layer system. By varying the optical properties of the first layer and observing the temperature rises at depth in the second layer, the experimental results can be used to verify mathematical expressions for optical and heat transfer processes of the two layers. Such a system was devised to determine the thermal conductivity between a silicone rubber patch and the living skin irradiated. It may also be used in evaluations of other two-layer systems where reflectance, transmittance and heat transfer properties are known and must be accounted for in the mathematical model. Author (GRA)

N74-14840# Naval Air Development Center, Warminster, Pa. Crew Systems Dept.

FREQUENCY THRESHOLD FOR TWO FLASH FLICKER AND CRITICAL FLICKER: WHY THEY DIFFER Progress Report

Robert M. Herrick 8 Jun. 1973 22 p refs

(AD-767322; NADC-73131-40) Avail: NTIS CSCL 06/16

The minimum interval detectable between two successive light flashes is longer than the minimum interval detectable when many flashes are viewed. The probability summation hypothesis is suggested to explain the difference. For a given flash duration, the minimum interval detectable decreases as a function of the number of flashes n, until n equals about 8 or 10; further increases in n cause no further changes in this interval. Of the total decrease in the interval from 2 to 99 flashes, about 90% is explained by the probability summation hypothesis. Author (GRA)

N74-14841# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

PREDICTION OF NIPTS DUE TO CONTINUOUS NOISE EXPOSURE

Daniel L. Johnson Jul. 1973 68 p refs Prepared in cooperation with EPA

(AF Proj. 7231)

(AD-767205; AMRL-TR-73-91; EPA-550/9-73-001-B) Avail: NTIS CSCL 06/19

The report compares the relationship of noise exposure to noise induced permanent threshold shift (NIPTS) as predicted by the currently available works of Passchier-Vermeer, Robinson, Baughn and Kryter, and the yet unpublished work of the National Institute of Occupational Safety and Health. The works of Passchier-Vermeer, Robinson, and Baughn are selected since these are the only works that completely predict the relationship between NIPTS and noise exposure for various audiometric frequencies,

sound pressure levels and population percentiles. The predictions of these three methodologies are averaged in order to provide one single relationship between continuous noise exposure and NIPTS. This relationship is presented in various ways so that the effect of noise exposure on hearing can be viewed in more than one way. Discussion concerning the type of frequency weighting, the equal energy rule, and long duration exposures is also provided. (Modified author abstract) GRA

N74-14842# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
FREE 17-OHCS LEVELS IN PAROTID FLUID AS INDICATORS OF HYPERTHERMIC STRESS
Marion T. Ulrich and Abbott T. Kissen May 1973 13 p refs Presented at the Aerospace Med. Assoc., Bel Harbour, Fla., May 1972
(AF Proj. 7222)
(AD-767207; AMRL-TR-73-3) Avail: NTIS CSCL 06/1

Physiologic parameters of rectal, skin, and body temperatures, body heat storage, heart rate, and parotid fluid 17-OHCS levels were obtained on human subjects during one hour hyperthermic exposures at 52C and 66C ambient air temperatures. Significant differences were noted between control and exposure values in all parameters (except parotid fluid 17-OHCS) where elevated responses correlated with duration and degree of thermal stress, reaching maximal values after 50 and 60 minutes of exposure. In the 17-OHCS response, fluctuations were observed for both the 66C and 52C exposures with primary peak elevations for each occurring at 20 minutes exposure and secondary peak elevations at 50 and 60 minutes, respectively. The parotid fluid corticosteroid level, with its shifting between normal and elevated values, is an unpredictable barometer of physiologic strain induced by heat stress. Author (GRA)

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N74-14843 British Library Lending Div., Boston Spa (England).
HAZARDS OF MICROWAVE RADIATION AND PROPOSALS FOR SCREENING RADAR TECHNICIANS
M. Phlak, V. Servus, and J. Schubertova 5 Jul. 1973 10 p refs Transl. into ENGLISH from Vojenske Zdravot. Listy (Prague), v. 38, no. 1, 1969 p 7-9
(BLL-OA-Trans-1270-(6196.3)) Avail: British Library, Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

An attempt was made to obtain information on the effects of microwave radiation on the body by screening radar technicians. Screening results show: (1) no organic damage could be detected by existing methods, and (2) subjective neurasthenic disorders found in technicians did not differ significantly from the control group. Author

N74-14844 British Library Lending Div., Boston Spa (England).
MODES OF CONTROL IN MANUAL CONTROL SYSTEMS
Hiroshi Tamura [1973] 19 p refs Transl. into ENGLISH from Keisoku Jidoseigyo Gakkai Ronbunshu (Japan), v. 8, no. 4, 1972 p 414-421 Presented at the 14th Meeting of the Autom. Control Federation, Nov. 1971
(BLL-RTS-7834) Avail: British Library Lending Div., Boston Spa, Engl.: £1.80 or 6 BLL photocopy coupons

A study was made of the adaptivity and learning function of a man in manual control systems. As an index of learning function, a numerical comparison of control results and changes in control mode were studied. Transfer functions, nonlinearity, and unsteadiness of human control actions were included. It was concluded that control mode changes are related to the experience and skill of subjects. Author

N74-14845* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MODIFICATION OF ONE MAN LIFE RAFT Patent
Ernest J. Soter, inventor (to NASA) Issued 1 Jan. 1974 4 p Filed 29 Oct. 1971 Supersedes N72-21076 (10 - 12, p 1563)
(NASA-Case-LAR-10241-1; US-Patent-3,781,933; US-Patent-Appl-SN-193672; US-Patent-Class-9-11A) Avail: US Patent Office CSCL 06K

A one man inflatable life raft is described. The raft has an inflatable tube perimetrically bounding the occupant receiving space with a flexible floor member. A zippered opening in the floor allows entry and facilitates the use of a constant diameter tube. An airtight fabric bulkhead divides the peripheral tube longitudinally into inflatable tube sections, where if either tube section were punctured, the bulkhead would move into the punctured section to substitute for the punctured wall portion and maintain the inflatable volume of the tube. The floor member is attached to the central portion of the tube wall so that either side of the raft can be the up side.
Official Gazette of the U.S. Patent Office

N74-14846*# Illinois Univ., Urbana. Dept. of Mechanical and Industrial Engineering.
PHYSIOLOGICAL AND ENGINEERING STUDY OF ADVANCED THERMOREGULATORY SYSTEMS FOR EXTRAVEHICULAR SPACE SUITS Final Report
J. C. Chato and B. A. Hertig Aug. 1972 485 p refs
(Grant NGR-14-005-103)
(NASA-CR-130811; ME-FR-400) Avail: NTIS HC $26.25 CSCL 06K

Investigations of thermal control for extravehicular space suits are reported. The characteristics of independent cooling of temperature and removal of excess heat from separate regions of the body, and the applications of heat pipes in protective suits are discussed along with modeling of the human thermal system. F.O.S.

N74-14847*# Northrop Corp., Beverly Hills, Calif. Electronics Div.
SKYLAB SO71/SO72 CIRCADIAN PERIODICITY EXPERIMENT Final Report
M. K. Fairchild and R. A. Hartmann Nov. 1973 99 p
(Contract NAS2-6897)
(NASA-CR-114706; Nort-73-320) Avail: NTIS HC $7.00 CSCL 06B

The circadian rhythm hardware activities from 1965 through 1973 are considered. A brief history of the programs leading to the development of the combined Skylab SO71/SO72 Circadian Periodicity Experiment (CPE) is given. SO71 is the Skylab experiment number designating the pocket mouse circadian experiment, and SO72 designates the vinegar gnat circadian experiment. Final design modifications and checkout of the CPE, integration testing with the Apollo service module CSM 117 and the launch preparation and support tasks at Kennedy Space Center are reported. Author

N74-14848# Oak Ridge National Lab., Tenn. Thermonuclear Div.
SAFETY WITH HIGH MAGNETIC FIELD SYSTEMS
J. N. Luton, Jr. Sep. 1973 28 p refs Presented at the Southern Area Res. and Develop. Symp. Submitted for publication
(Contract W-7405-eng-26)
(ORNL-TM-4313) Avail: NTIS HC $3.50

Based on a consideration of the laboratory environment and on the physical characteristics of high field magnet coils and of humans, some hazards and safety precautions concerning steady state magnet systems are discussed. Author (NSA)

N74-14849# Calspan Corp., Buffalo, N.Y.
AN EVALUATION OF THE DYNAMIC PERFORMANCE CHARACTERISTICS OF ANTHROPOMORPHIC TEST DEVICES, VOLUME 3 Final Report, Jun. 1971 - Nov. 1972
James B. Walunas and J. Sam Miller May 1973 97 p refs
(Contract DOT-HS-053-1-129)
(PB-223106/6; CALSPAN-FA-5018-V-3-Vol-3; DOT-HS-800-863-Vol-3) Avail: NTIS HC $3.75 CSCL 13F

The dynamic performance of a state-of-the-art 95th percentile anthropomorphic dummy was determined under conditions approximating those expected in vehicle compliance testing.
GRA

N74-14850# Hughes Aircraft Co., Culver City, Calif.
ECONOMICAL MULTIFACTOR DESIGNS FOR HUMAN FACTORS ENGINEERING EXPERIMENTS
Charles W. Simon Jun. 1973 191 p refs
(Contract F44620-72-C-0086; AF Proj. 9778)
(AD-767739; HAC-P73-326; AFOSR-73-1702TR) Avail: NTIS CSCL 05/5

Experimental data collection plans are described that permit the study of from five to thirty experimental human factors. The reported plans were selected from those employed in physical science research and were suitable for human factors engineering research. The method of employing these designs is two phase. In the first phase, a large number of potentially critical factors are systematically screened in a way that identifies the more important ones. In the second, functions are obtained that relate the more important quantitative factors to operate performance. Five principles that enable economical miltifactor human factors experiments to be successfully conducted are stated. (Modified author abstract) GRA

N74-14851# School of Aerospace Medicine, Brooks AFB, Tex.
X-RAY FLUOROMETER AND SOLID STATE DETECTOR CALIBRATION FOR BIOLOGIC SPECIMEN ANALYSIS Final Report, Jun. - Dec. 1972
Ted D. Rupp and John L. Montet Aug. 1973 43 p refs
(AF Proj. 7757)
(AD-767585; SAM-TR-73-17) Avail: NTIS CSCL 06/18

Due to the recent demand for data concerning radiofrequency (RF) hazards to man, extensive information is now needed on the normal metabolites of experimental animals exposed to various RF fields. The metal content of blood plasma is known to respond to various thermal environments. This response is thought to be the primary means by which RF fields affect most biologic systems. X-ray fluorescence has recently been shown to be a feasible technique, by means of using lithium-drifted silicon or germanium solid-state detectors, for the simultaneous determination of several metals in biologic samples. This report describes the source arrangement and calibration of such a fluorometer, as well as the calibration of the solid-state detectors in the 3.5 Kev to 3.5 Mev energy region. Also included is the application of the completed apparatus to X-ray fluorescence analysis of biologic systems. (Modified author abstract) GRA

N74-14852# McDonnell-Douglas Astronautics Co., St. Louis, Mo. Engineering Psychology Dept.
PREDICTING MAINTENANCE TASK DIFFICULTY AND PERSONNEL SKILL REQUIREMENTS BASED ON DESIGN PARAMETERS OF AVIONICS SUBSYSTEMS
Larry M. Lintz, Susan L. Loy, Gerald R. Brock, and Kenneth W. Potempa Aug. 1973 135 p refs
(Contract F33615-71-C-1620; AF Proj. 1124)
(AD-768415; AFHRL-TR-72-75) Avail: NTIS CSCL 05/9

The relationships among subsystem design characteristics, personnel skill characteristics, and job performance were investigated for avionics subsystems. A list of design characteristics was established, and functional loops and line replaceable units were selected from ten subsystems representing navigation, flight control, communications, and fire control subsystems. Experienced supervisors identified high and low skill maintenance personnel. These supervisors associated performance times and error probabilities for three maintenance tasks - an easy task, a difficult task, and a complete functional checkout task. Supervisors also rated each task on a scale of difficulty. GRA

N74-14797 Joint Publications Research Service, Arlington, Va.
MATHEMATICAL EVALUATION OF RELIABILITY OF FUNCTIONING OF THE BIOLOGICAL LINK IN A BIOENGINEERING SYSTEM
I. A. Shvytov *In its* Space Biol. and Med., Vol. 7, No. 6, 1973 (JPRS-61020) 18 Jan. 1974 p 15-20 refs Transl. into ENGLISH of the periodical "Kosmicheskaya Biologiya i Meditsina, v. 7, no. 6, 1973" Moscow, Med. Izd., Nov.-Dec. 1973 p 13-17 (For availability see N74-14794 06-04)

N74-14799 Joint Publications Research Service, Arlington, Va.
INFLUENCE OF NATURE OF DISTRIBUTION OF ABSORBED DOSE ON RADIATION DAMAGE
G. M. Avetisov, V. N. Budylin, V. G. Gorlov, and V. S. Grammatikati *In its* Space Biol. and Med., Vol. 7, No. 6, 1973 (JPRS-61020) 18 Jan. 1974 p 24-34 refs Transl. into ENGLISH of the periodical "Kosmicheskaya Biologiya i Meditsina, v. 7, no. 6, 1973" Moscow, Med. Izd., Nov.-Dec. 1973 p 19-26 (For availability see N74-14794 06-04)

06 CHEMISTRY

Includes chemical analysis and identification (e.g. spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N74-14853 British Library Lending Div., Boston Spa (England).
DISTRIBUTION COEFFICIENTS AND SOLUBILITY CURVES OF SOME RARE-EARTH ELEMENTS IN GaAs
V. N. Romanenko and V. S. Kheifets 5 Jul. 1973 11 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Neorgan. Materialy (Moscow), v. 9, no. 2, 1973 p 190-196
(BLL-RRE-Trans-400-(8036.625)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

The distribution coefficients of Dy and Gd in GaAs have been determined. They equal (4.8 plus or minus 1.5) x 0.01 for Dy and (6.0 plus or minus 1.8) x 0.01 for Gd. A method is proposed for determining the distribution coefficients of volatile impurities from analysis of the concentration curve. The distribution coefficient of Sm in GaAs was determined by this method. Its value was found to be equal to (8.0 1.2) x 0.01. The curves of solubility of Dy, Gd and Sm in GaAs with vacancies in the As sub-lattice were determined. Author

N74-14854 British Library Lending Div., Boston Spa (England).
DETERMINATION OF THE EFFICIENCY OF A SERIES OF STABILIZERS IN THE LIGHT STABILIZATION OF POLYESTER RESINS
V. N. Arkozhovskii Aug. 1973 15 p refs Transl. into ENGLISH from Sb. Tr. Nauchn. Issled. Inst. Novykh Stroitelnykh Materialov (Moscow), v. 17, no. 25, 1967 p 40-46
(BLL-RTS-8287) Avail: British Library Lending Div., Boston Spa, Engl.: £1.40 or 5 BLL photocopy coupons

In determination of the light stability of polymers it is proposed to use their absorption coefficient. It has been shown that such a method of investigation is more accurate than the method based on the change in light transmission. Compounds studied for the light stabilization of polyester resins are 2-(2'-hydroxy-5'-methylphenyl)-benzotriazole, 2-hydroxy-4-methoxybenzophenone and p-tert-butylphenylsalicylate (in decreasing order of activity). It is not expedient to use the phenyl ester of 3,5-dichlorosalicylic acid, butyl gallate or the ethylene glycol ester of 3-hydroxy-4-benzoylacetic acid as light stabilizers for polyester resins. Author

N74-14855 British Library Lending Div., Boston Spa (England).
WETTING KINETICS IN CONDITIONS OF INTENSIVE SOLUTION
G. A. Grigorev [1973] 9 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (USSR), v. 5, 1973 p 13-16
(BLL-M-21771-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

Thermodynamics of irreversible processes were employed in an examination of the wetting process resulting from submerging of solid bodies in liquids. Relationships which take into account the effect of dispersion on wetting kinetics were obtained. Experimental results illustrating the validity of the equations obtained are presented. Author

N74-14856 Houston Univ., Tex.
CHROMATOGRAPHY WITH SUPERCRITICAL FLUIDS INVESTIGATION OF OPERATING PARAMETERS FOR LIQUID-SOLID FLUID CHROMATOGRAPHY, 1. PERFORMANCE OF A SULFUR SENSITIVE FLAME PHOTOMETRIC DETECTOR. APPLICATION TO SULFUR COMPOUNDS IN CIGARETTE SMOKE, 2 Ph.D. Thesis

Wolfgang Bertsch 1973 152 p
Avail: Univ. Microfilms Order No. 73-22891

An investigation was made of the operating parameters for SFC (super critical fluid chromatography). The elution behavior of a substance was found to be primarily a function of the pressure and temperature of the fluid and temperature of the fluid and to a far smaller extent on the column used. Small differences in the adjustments of pressure, especially close to the critical conditions yielded significantly large differences in elution behavior. The distribution coefficient K can be readily changed by an increase or decrease in pressure of only a few psi, especially in the neighborhood of the critical conditions. It is favorable to work some 10 or 20 C above the critical temperature, since each column has a certain pressure drop and a partition gradient would exist along the column. Although small particle size packings decrease the height of an equivalent plate HETP, high pressure drops result. It was found that a compromise between particle size and pressure drop is necessary.
Dissert. Abstr.

N74-14857 Pennsylvania Univ., Philadelphia.
A STEADY-STATE ELECTROCHEMICAL CELL INVESTIGATION OF THE KINETICS OF THE SOLUTION OF OXYGEN INTO THE LIQUID LEAD, LIQUID COPPER AND LIQUID COPPER-SULFUR SYSTEMS USING CO2-CO MIXTURES Ph.D. Thesis
Constance Foster Acton 1973 219 p
Avail: Univ. Microfilms Order No. 73-24107

The kinetics of solution of oxygen from CO2-CO and CO2-CO-Ar gas mixtures into liquid lead, liquid copper, and liquid copper containing sulfur were investigated using an electrochemical technique. Data for all systems were generated by a steady state experimental method. Additional unsteady state measurements which provide an independent confirmation of the steady state results were made. Dissert. Abstr.

N74-14858 California Univ., Los Angeles.
GASES AT HIGH PRESSURES AND TEMPERATURES Ph.D. Thesis
Basil Peter Roman 1973. 116 p
Avail: Univ. Microfilms Order No. 73-23408

Techniques are described for measuring the transient pressure, temperature, and specific volume/density of a dense, high pressure-high temperature gas. These techniques involve new applications of a sodium spectral line reversal system and a contactless displacement transducer. Data are presented for nitrogen and helium produced by means of a piston compression process, with pressures up to 3000 atmospheres and temperatures to 2400 K for nitrogen and 4500 K for helium. The second and third virial coefficients were determined from these compressibility measurements. The representation of the second virial coefficient is quite satisfactory when compared with the theoretical values for a Lennard-Jones (6,12) potential as tabulated by Bird, Spotz, and Hirschfelder. The second virial coefficient agrees also well with the tabulated values of Buckingham and Corner expsix potential. The third virial coefficient agrees moderately well with the theoretical values for the Lennard-Jones and exponential-six potentials. Dissert. Abstr.

N74-14859 Arkansas Univ., Fayetteville.
ALTERATIONS OF THE ISOTOPIC COMPOSITIONS OF THE NOBLE GASES BY NUCLEAR ASTROCHEMICAL PROCESSES Ph.D. Thesis
Ronald Hobart Thompson 1973 107 p
Avail: Univ. Microfilms Order No. 73-27402

Isotropic compositions of rare gases released from the meteorite Bruderheim and the krypton and xenon released from the dark portion of the Potter meteorite were determined mass-spectrometrically in a stepwise heating experiment. The neon data can be best interpreted on the basis of Manuel's 1967 postulate that the neon consists of three components (a) cosmic ray produced, (b) primordial, (c) mass fractionated primordial gas. The argon and krypton data can be similarly explained on the basis of three components (a), (b), and (c) mentioned above, plus the addition of excess Ar -40 from the decay of K-40. The xenon data is also explained by components (a), (b), and (c) plus excess Xe-129 from the decay of -129 and a component (f) to include the fissiogenic xenon from the well established contribution of the spontaneous fission of Pu-244. An equation used by Aston enables one to calculate the extent to which the primordial rare gases can be mass fractionated within the solar system. Dissert. Abstr.

N74-14860# National Aeronautical Lab., Bangalore (India). Propulsion Div.
RAPID ESTIMATION OF SILICON CONTENT IN ALUMINUM-SILICON ALLOYS BY MEANS OF DIRECT PERCENTAGE INDICATING THERMOMETRIC METHOD
I. Sajo and A. Sipos [1972] 14 p refs Transl. into ENGLISH from Commun. from Steel Res. Inst. (Budapest), 1969 p 55-57
(NAL-TR-146) Avail: NTIS HC $3.00

A method of rapid estimation of Si-content of A1-Si alloys is described. By this method a sample is dissolved in a mixture of HF, Hel and HN03 whereby the Si in the sample is converted quantitatively into H2 Si F6. To the above prepared sample solution is added Kcl as reagent when the formed H2 Si F6 is precipated as K2 Si F6 from the solution. During the course of this reaction the significant development of heat of reaction alters the temperature of the sample solution in proportion to the Si-content of the sample. By measuring the temperature change of the sample solution one can estimate the Si-content of the sample. The appropriately built measuring instrument gives the Si-content of the sample directly in percentage. Author

N74-14861# Bureau of Mines, Bartlesville, Okla. Bartlesville Energy Research Center.
OXYGENATES IN AUTOMOTIVE EXHAUSTS: EFFECT OF AN OXIDATION CATALYST
D. E. Seizinger 1973 24 p refs
(BM-RI-7837) Avail: NTIS HC $3.25

Analytical methods for oxygenates in exhaust gases were studied, and emissions of these compounds from automotive engines were measured with and without an oxidation catalyst in the exhaust system. Hydrocarbon, simple mixtures of hydrocarbons, and a single gasoline were used as fuels. With the more complex gasoline, successful analysis was possible only with exhaust from the catalytic system which preferentially converted and thus removed interfering hydrocarbon species. However, it was shown that an estimate of the oxygenate yield from gasoline used in a noncatalytic system can be synthesized from data obtained with simple fuels. Such synthesized data were used for comparison of noncatalytic with catalytic systems. Compared with those of previous studies, results of this work indicate that the action of the catalyst introduced no new oxygenates and reduced both the carbonyl and the total of oxygenates. It is concluded that the compositional character and class distribution of oxygenates in exhaust from catalytic systems may differ significantly from the composition and distribution from oxygenates not subjected to catalytic conversion. The findings also support previous estimates that noncarbonyls may constitute a significant fraction of exhaust oxygenates. Author

N74-14862*# Kanner (Leo) Associates, Redwood City, Calif.
FINDING THE MOST CONSISTENT MOLECULAR WEIGHT BY ANALYSIS OF THE AMINO ACIDS OF A PROTEIN
M. Delaage Washington NASA Jan. 1974 7 p refs Transl. into ENGLISH from Biochim. Biophys. Acta (Amsterdam), no. 168, 1968 p 573-575
(Contract NASw-2481)
(NASA-TT-F-15274) Avail: NTIS HC $3.00 CSCL 07C

A method is given for determining the molecular weight of a protein on the basis of its amino acid composition. Two procedures are outlined, one using a computer and the other mathematical tables. Possibilities for error are discussed briefly.
Author

N74-14863*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
QUANTITATION AND DETECTION OF VANADIUM IN BIOLOGIC AND POLLUTION MATERIALS
William A. Gordon Jan. 1974 34 p refs
(NASA-TM-X-71497; E-7853) Avail: NTIS HC $3.75 CSCL 07D

A review is presented of special considerations and methodology for determining vanadium in biological and air pollution

materials. In addition to descriptions of specific analysis procedures, general sections are included on quantitation of analysis procedures, sample preparation, blanks, and methods of detection of vanadium. Most of the information presented is applicable to the determination of other trace elements in addition to vanadium. Author

N74-14864*# Hughes Aircraft Co., Culver City, Calif.
SYNTHESIS OF TEREPHTHALONITRILE N,N-DIOXIDE Final Report
K. E. VanBuren Dec. 1973 13 p refs
(Contract NAS2-7831)
(NASA-CR-114705) Avail: NTIS HC $3.00 CSCL 07C

The preparation is described of terephthalonitrile N,N prime-dioxide by the chlorination of terephthalaldehyde dioxime to yield terephthalohydroximol chloride, to which absolute methynol was added to yield the TPNO. F.O.S.

N74-14865*# Kanner (Leo) Associates, Redwood City, Calif.
ON THE STRUCTURE OF PHOSPHORUS COMPOUNDS
R. Wolf Washington NASA Jan. 1974 22 p refs Transl. into ENGLISH from Decouverte (France), Dec. 1972 p 4-11
(Contract NASw-2481)
(NASA-TT-F-15282) Avail: NTIS HC $3.25 CSCL 07D

A discussion is presented of the basic principles underlying bonding in organic phosphorus compounds. A brief review is made of the position of organic chemistry in the chemical field and the primary uses of the compounds with which it deals. Subsequently each of the possible bonding valences for phosphorus are treated in turn: the 3, 4 and 5 coordinations as well as the more unusual 1, 2 and 6 coordinations. Compounds which are only formally predictable are distinguished from those which have actually been prepared. Author

N74-14866# Du Pont de Nemours (E. I.) and Co., Wilmington, Del. Elastomers Lab.
PERMALUX AS A CURE ACCELERATOR FOR NEOPRENE
D. H. Geschwind 25 Jan. 1974 15 p
(SD-207) Avail: NTIS HC $3.00

PERMALUX is one of the oldest commercially available accelerators for Neoprene, predating NA-22. Although it has been overshadowed by NA-22 for many years, it has never been completely abandoned and remains today as a versatile and widely used accelerator. PERMALUX is approved as an accelerator for rubber articles intended for repeated use in contact with food. Cure acceleration of Neoprene compounds by PERMALUX is similar in many respects to acceleration with NA-22. Author

N74-14867# Oak Ridge National Lab., Tenn.
COMPATIBILITY OF BRAZING ALLOYS AND THE MOLTEN SALT NaBF4-8 MOLE PERCENT NaF AT 610 C
J. W. Koger Dec. 1972 44 p refs
(Contract W-7405-eng-26)
(ORNL-TM-4272) Avail: NTIS HC $4.25

A comprehensive review of the compatibility of braze alloys with molten fluoride salts was performed. Eight different braze alloys, used to braze Hastelloy N, were exposed to NaBF4-8 mole % NaF at 610 C for 4987 h. On the basis of weight changes, microstructural changes, and electron microprobe analysis, all alloys tested were compatible. The Ag-28% Cu and 100% Cu braze alloys were considered the most resistant. The prediction of corrosion resistance on the basis of free energy of formation data was in reasonable agreement with the results. Nickel transferred to non-nickel-containing braze alloys through an activity gradient mass transfer mechanism. Some deposits were noted on the Hastelloy N base material. Significant interdiffusion of the Hastelloy N and the braze alloy occurred only with those braze alloys whose composition was near that of Hastelloy N. Author (NSA)

N74-14868# Oak Ridge National Lab., Tenn.
FORCED-CIRCULATION LOOP FOR CORROSION STUDIES: HASTELLOY N COMPATIBILITY WITH NaBF4-NaF (92-8 mole PER CENT)
J. W. Koger Dec. 1972 20 p refs
(Contract W-7405-eng-26)
(ORNL-TM-4221) Avail: NTIS HC $3.00

A sophisticated pumped loop system was designed and operated to study the compatibility of Hastelloy N with flowing NaBF4-NaF (92.8 mole %) at a maximum temperature of 620 and a minimum of 454 C. One unique feature of the design of this loop was the ability to remove or add corrosion test specimens without draining the fluid from the loop. Principal test variables included temperature, velocity, time, and impurities in the fluid. Measurements disclosed weight losses in hot zone specimens, weight gains in cold zone specimens, with a balance point at a temperature halfway between the maximum and minimum. Under certain conditions, larger weight losses and gains were found in specimens exposed to high velocity salt. In time, mass transfer rates became much lower, and no velocity effect was noted. Specimen examination early in the life of the loop disclosed a definite downstream effect. Author (NSA)

N74-14869# Army Coating and Chemical Lab., Aberdeen Proving Ground, Md.
FLASH DISTILLATION METHOD AND ITS APPLICATION FOR ANALYSIS OF PETROLEUM FUELS Final Report
Marjan Kolobielski Aug. 1973 25 p refs
(DA Proj. 1T6-62611-A-106)
(AD-768157; CCL-3005) Avail: NTIS CSCL 07/3

There exists a need in the petroleum area for a method to determine the nonvolatile components of petroleum fuels, gasoline, distillates, and fuel oil, without alteration of these components. In the present study this objective was accomplished by developing a new laboratory method. In this method the fuel is evaporated under high vacuum at moderate temperatures by using a short-path laboratory rotating evaporator. The method was applied to the analysis of gasoline, detergent additive in gasoline, and heavy petroleum bottoms contaminants in diesel fuel. In the latter example the method demonstrated a significant correlation between the amount of the heavy nonvolatile component and the absorption of diesel fuel in the visible region of spectrum. Author (GRA)

N74-14870# Arizona Univ., Tucson. Dept. of Physics.
ON THE POSSIBILITY OF HIGH PRECISION BEAM-FOIL SPECTROSCOPY USING A MODIFIED LAMB-DIP TECHNIQUE
W. Chow, A. D. Maio, and M. O. Scully 1972 12 p refs Presented at 3d Intern. Conf. on Beam-Foil Spectroscopy, Tucson, Ariz., 1972 Submitted for publication
(Grant AF-AFOSR-1921-70; AF Proj. 9768)
(AD-767666; AFOSR-73-1670TR) Avail: NTIS CSCL 07/4

The application of beam-foil techniques to high precision atomic physics is complicated by dispersion in the atomic velocities. This is analogous to the thermal Doppler broadening found in conventional laboratory sources. The advent of stable high-intensity laser sources has led to saturation (Lamb-dip) spectroscopy, which enables measurement eigenfrequencies and natural lifetimes independent of the Doppler width. The application of this idea to beam-foil experiments involves two (tunable) laser sources. A simple calculation suggests that the resolution might be improved by several orders of magnitude. (Modified author abstract) GRA

N74-14871# Bishop Coll., Dallas, Tex.
RADIATION-INDUCED GRAFTING ON POLYAMIDES
Joseph E. Wilson Sep. 1973 33 p refs Submitted for publication
(Contract N00014-72-C-0052; NR Proj. 356-520)
(AD-767720; TR-3) Avail: NTIS CSCL 07/3

Earlier work indicated that in the radiation-induced grafting of vinyl monomers on polymeric films, the plasticity of the film being grafted is determined by the Hildebrand solubility parameter of the grafting solution. In the grafting of styrene on nylon film, a sequence of irradiation runs was made at selected volume ratios of styrene/benzene/methanol, all grafting solutions having a constant solubility parameter value of 7.8. A similar sequence of runs grafted pentafluorostyrene on nylon film at constant solubility parameter. Styrene was grafted on polyethylene film in a sequence of four runs using styrene dissolved in methanol, ethanol, 1-propanol, and 1-butanol, each solution having the same solubility parameter of 10.4. A straight-line plot of grafting rate versus volume percent styrene was obtained. (Modified author abstract) GRA

N74-14872# Rockwell International Science Center, Thousand Oaks, Calif.
MECHANISMS OF FORMATION AND COMPOSITION OF PHOTOCHEMICAL AEROSOLS Final Report
M. Lipeles, C. S. Burton, H. H. Wang, E. P. Parry, and G. M. Hidy Sep. 1973 104 p refs Sponsored by EPA
(PB-223960/6GA; CRC-APRAC-CAPA-8-71-1) Avail: NTIS HC $4.25 CSCL 07E

A feasibility study is detailed of a flow reactor concept for the study of the mechanism of formation and composition of photochemical aerosols. The technique involves a fast flow reactor which may be operated in a wall free mode. Aerosols have been produced in this reactor from a light irradiated gas mixture including NO2, 1-hexene, SO2, H2O, and air. The chemical composition of these aerosols has been analyzed. Aerosols were also sought in a NO2, 1-hexene, and dry air mixture but have not yet been obtained. Preliminary design studies, an experimental study and a discussion of related aspects of aerosol formation in ozone olefin reactions are included. (Modified author abstract) GRA

N74-14873# Woods Hole Oceanographic Institution, Mass.
THE FINNIGAN 1015 GAS CHROMATOGRAPH-MASS SPECTROMETER SYSTEM: COMMENTS OF NINETEEN USERS
Max Blumer Oct. 1973 46 p refs
(Contract N00014-66-C-0241; Grant NSF GA-35646; NR Proj. 083-004)
(AD-768286; WHOI-73-67) Avail: NTIS CSCL 07/4

Nineteen users of the Finnigan 1015 Gas Chromatograph-Mass Spectrometer System were interviewed about their experience. The survey was directed principally at instrument performance (satisfaction, down time, major problems, stability, service problems), samples (type and size, inlets, data treatment), modifications and use (closed vs. open facility, background and duty of the operators, sensitivity and performance checks and special applications). The responses are discussed and tabulated and compared to the authors' experience with a CEC (now DuPont) 21-104 mass spectrometer. (Modified author abstract) GRA

N74-14874# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
ELEMENTAL ANALYSIS OF MATERIALS BY ENERGY DISPERSIVE SPECTROMETRY OF X-RAYS PRODUCED BY A FOCUSING ELECTRON GUN M.S. Thesis
William Charles Nielsen, Jr. Mar. 1973 99 p refs
(AD-768352; GEP/PH/73-16) Avail: NTIS CSCL 07/4

The construction and operation of a system for elemental analysis of materials by energy-dispersive X-ray analysis are described. Fluorescent X rays from samples are excited either directly by electrons from the gun or by secondary X rays produced by using the electrons to excite interchangeable thin targets. With electron energies up to 40 keV and beam currents as high as 300 microamps elemental concentrations as low as 0.1 micrograms and less than 10 ppm have been detected with short exposures. The sensitivity of this system is compared to systems which use radionuclides and protons to excite X rays. (Modified author abstract) GRA

N74-14875# Atlantic Research Corp., Alexandria, Va.
METAL OXIDATION IN A VACUUM TANK Final Technical Report, 1 Jan. - 1 Jun. 1973
Andrej Macek Jul. 1973 27 p refs
(Contract F30602-72-C-0426; ARPA Order 1649)
(AD-768925; RADC-TR-73-281) Avail: NTIS CSCL 07/4

Experiments were performed by a technique in which the metal is vaporized from an electrically heated container made of tantalum or tungsten. This technique was demonstrated to be efficient for quantitative metal-release studies. Eleven releases of aluminum into air have been made with metal-vapor flow rates of the order of 50 mg/sec at heater temperatures of 2400K, over the high-altitude chamber pressures from 13.6 to 0.2 torr (35 to 60km altitude). All these releases generated visible luminosity, ascribed to the doublet B to doublet X AlO band spectrum. An approximate analysis of the spectral intensities indicates formation of AlO in the ground vibrational state, probably by the rapid reaction Al - O2 to AlO O. Chemiluminescence caused by active species (O,O3) is not indicated. Attempts to demonstrate release of uranium were unsuccessful. (Modified author abstract) GRA

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N74-14876 British Library Lending Div., Boston Spa (England).
THE SAMPLE AND HOLD PROCESS IN A PCM VIDEO SYSTEM
Gianfranco Barbier, F., Mario Cominetti, and Paolo Damato 3 Sep. 1973 20 p refs Transl. into ENGLISH from Elettronica e Telecomun. (Italy), no. 3, 1972 p 103-110
(BLL-PO-2961-(9022.81)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

The sample and hold circuit in a coder for transforming the input signal into an acceptable form for the analog to digital converter is described. The one in the decoder is used to eliminate, from the output signal, the transients due to switching of the logic circuits in the analog to digital converter. In both cases, the performance of the sample and hold circuit has a definite influence on the quality of the coding-decoding processes. The basic design principles are explained for a sample and hold circuit. The distortion which the process introduces to the coded-decoded signal it analyzed and calculations are given for the equalizer which must be inserted at the output of the decoder in order to compensate for the linear distortions. Author

N74-14877 British Library Lending Div., Boston Spa (England).
SIGNAL ACCELERATION BY NEGATIVE GROUP AND PHASE DELAY
J. Wobst 10 Oct. 1973 22 p refs Transl. into ENGLISH from Nachrichtentechnik (Berlin), v. 14, no. 6, 1964 p 206-213
(BLL-RDL-Trans-2503-(9022.81)) Avail: British Library Lending Div., Boston Spa, Engl.: 3 BLL photocopy coupons

The characteristics of transmission networks with negative group and phase delay are discussed. The networks are capable of delaying signals of limited spectrum by definite given amounts after negative time. The characteristics of negative delay is applied to the signal predetermination theory. An analysis is made of the networks with special reference to their use in signal acceleration to show their possibilities and limits which are very restricted. Mathematical models are developed to show the signal deformation by deviation from ideal frequency response. Author

N74-14878 British Library Lending Div., Boston Spa (England).
A LOW-PASS FOUR-POLE PULSE SHAPER
P. Allemandou 8 Nov. 1973 11 p refs Transl. into ENGLISH from Cables et Transmission (Paris), v. 26, no. 4, Oct. 1972 p 331-337
(BLL-RDL-Trans-2990-(9022.81)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

A method is reported which allows a computation for low pass four poles which present the following properties: firstly, attenuation greater than a given quantity A sub min for any frequency above an f sub c frequency; secondly, an inter-symbol interferer :e masking noise level for the output signal which is low for an input signal made up of a unit amplitude impulse of finite, non-zero width. Author

N74-14879 British Library Lending Div., Boston Spa (England).
CHROMINANCE DISTORTION IN A LINEAR PCM VIDEO SIGNAL
P. DAmato 3 Sep. 1973 17 p refs Transl. into ENGLISH from Elettronica e Telecomunicazioni (Turin), no. 3, 1972 p 111-118
(BLL-RDL-Trans-2962-(9022.81)) Avail: British Library Lending

Div., Boston Spa, Engl.: 2 BLL photocopy coupons

The chrominance distortions introduced by PCM video coder quantizing process are analyzed, taking into account only the case in which the sampling frequency is three times the subcarrier frequency. According to this hypothesis, the maximum amplitude and phase errors in steady state conditions are computed and the process by means of which differential gain and phase distortions are generated is examined in detail. The results obtained are particularly useful to determine the features of PCM video coders used for measurement of ITS signals. Author

N74-14880 British Library Lending Div., Boston Spa (England).

INFORMATION REDUCTION FOR VIDEO SIGNALS

H. Schoenfelder 3 Sep. 1973 5 p Transl. into ENGLISH from Intern. Elektron. Rundschau (Berlin), v. 27, no. 1, 1973 p 1-2

(BLL-RDL-Trans-2992-(9022.81)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

Special methods used to solve problems relating to information reduction for video signals are discussed. E.H.W.

N74-14881 British Library Lending Div., Boston Spa (England).

INTERFRAME CODING FOR VIDEO SIGNALS

H. Wendt 3 Sep. 1973 16 p refs Transl. into ENGLISH from Int. Elektron. Rundsch. (Berlin), v. 27, no. 1, 1973 p 2-7 (BLL-TDL-Trans-2993-(9022.81)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

Interframe codings for video telephone signals which make use of the temporal redundancy of still picture regions and the redundancy of the picture in moving picture regions for reducing information flow are discussed. The concept of interframe coding is explained, starting from the results obtained and observations made of the universal experimental arrangement for interframe coding. The proposal avoids the various disadvantages of known coding methods and makes a comparison with conventional methods. Author

N74-14882 British Library Lending Div., Boston Spa (England).

AN ELECTRONIC TELEPHONE EXCHANGE AT ROISSY-EN-FRANCE AIRPORT

J. Trelut 5 Jul. 1973 42 p refs Transl. into ENGLISH from Commutation et Elec. (France), no. 40, Jan. 1973 p 66-85 (BLL-PO-2986-(9022.81)) Avail: British Library Lending Div., Boston Spa, Engl.: 5 BLL photocopy coupons

A new capacity Metaconta L automatic exchange was installed at the Roissy-en-France Airport. The following main features of the telephone system are described: centrex type service; autonomy of routing and call fees charging; new facilities; stored program control with an LCT 3200 computer; modularity of the equipment and programming; and reliability of the system. Author

N74-14883 British Library Lending Div., Boston Spa (England).

AN ADAPTIVE INTRAFRAME CODER FOR TELEVISION SIGNALS

B. Wendland and F. May 5 Jul. 1973 20 p refs Transl. into ENGLISH from Int. Elektron. Rundsch. (Germany), v. 27, no. 1, 1973 p 12-18

(BLL-PO-2995-(9022.81)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

The characteristics of an adaptive intraframe coder for television signals are discussed. The pulse code modulation of digitalized television signals with a basic bandwidth of 5 MHz requires an information rate of about 70 Mbit per second for satisfactory picture quality. The adaptive coder reduces the information rate by a factor of one to five for approximately equal picture quality. The adaptive coder reduces the information rate by a factor of one to five for approximately equal picture quality. The proposed and realized method gives pictures which are very finely quantized in low detail picture regions and coarsley quantized in highly detailed zones. Coding examples show that the resulting reconstruction errors are practically irrelevant as far as the human eye is concerned. Author

N74-14884 British Broadcasting Corp., Kingswood (England). Research Dept.

MEASUREMENTS ON TYPICAL ARRANGEMENTS OF UHF PANEL AERIALS

G. H. Millard and J. H. Moore Nov. 1973 9 p refs (BBC-RD-1973/33) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

Measurements were made of the impedance and radiation patterns of UHF panel aerials in an effort to determine the probable limits of performance variations when the aerials are assembled from standard parts. Author

N74-14885 Colorado Univ., Boulder.

A TECHNIQUE FOR THE TRANSMISSION OF COHERENT BROADBAND MILLIMETER-WAVE SIGNALS AND ITS APPLICATION TO PROPAGATION, PRECISE DISTANCE MEASURING, AND REMOTE OSCILLATOR SYNCHRONIZATION Ph.D. Thesis

Lockett Eason Wood 1973 214 p

Avail: Univ. Microfilms Order No. 73-23314

Microwave frequencies of 9.5, 19.1, 22.2, 25.4, and 33.3 GHz were generated coherently and transmitted over a 65-km atmospheric propagation path. The first four signals were transmitted from a common antenna, and the 33.3-GHz antenna was co-located so that all signals traveled a nearly-common path. This arrangement permitted the measurement of the propagation properties of the low elevation atmospheric path to five frequencies simultaneously. The signal properties of amplitude, round-trip phase were measured. From these measurements the phase power spectra amplitude power spectra and signal coherencies are computed. It is shown that for broadband signals the increased signal variation near 33 GHz offsets the additional attenuation caused by the water vapor absorption near 22 GHz. The phase signals are shown to be highly coherent over the full 20 GHz bandwidth although the amplitude coherency is low on occasion. Dissert. Abstr.

N74-14886 Maryland Univ., College Park.

A NEW APPROACH TO TELEMETRY DATA PROCESSING Ph.D. Thesis

Carlo Joseph Broglio 1973 174 p

Avail: Univ. Microfilms Order No. 73-23723

An approach to a preprocessing system for telemetry data processing was developed. The philosophy of this approach is the development of a preprocessing system to interface with the main processor and relieve it of the burden of stripping information from a telemetry data stream. To accomplish this task, a telemetry preprocessing language was developed. This higher level language contains statements designed using the jargon of telemetry data engineers and a set of simple but powerful operators for manipulating telemetry data. Also, a hardware device for implementing the operation of this language was designed using a cellular logic module concept. In the development of the hardware device and the cellular logic module, a distributed form of control was implemented. A compiler for translating the preprocessing language statements into an operations table for the hardware device was also developed. Finally, to complete the system design and verify it, a simulator for the cellular logic module was written using a APL/360 system. Dissert. Abstr.

N74-14887 British Broadcasting Corp., Kingswood (England).

A STUDY OF HIGH ORDER VERTICAL APERTURE CORRECTION

J. O. Drewery Nov. 1973 25 p refs

(BBC-RD-1973/36) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

The process of vertical aperture correction involving signal contributions from more than two lines adjacent to the corrected line has been studied theoretically. The conclusion is reached that little is gained by increasing the complexity of correction, and the results of subjective tests confirm this. Author

N74-14888 Iowa State Univ. of Science and Technology, Ames.

A MODEL STUDY OF THE EFFECT OF AN ATMOSPHERIC THERMAL PLUME ON A LINE-OF-SIGHT RADIO LINK Ph.D. Thesis

Vera Onthuam 1973 75 p

Avail: Univ. Microfilms Order No. 73-25248

Thermal plumes were observed as common occurrences in the natural environment by researchers using acoustic echo-sounders and in-situ measurements. Their occurrence can be expected to effect the propagation of acoustic, radio, and optical waves in the atmosphere. By applying the frequency scaling technique, long used by the antenna engineers, the thermal plume and the waves were scaled down to a laboratory-sized model. A helium-neon gas laser operating at 6328 A was used to simulate the radio wave while a column of heated air was used to simulate the natural thermal plume. A photodiode detector was used to detect the laser beam, and a camera was used to record the behavior of the simulated plume at the required moments.

Dissert. Abstr.

N74-14889*# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.

PROCESSING AND TRANSMISSION OF INFORMATION Quarterly Progress Report

15 Jul. 1973 11 p refs

(Grant NGL-22-009-013)

(NASA-CR-136619; QPR-110) Avail: NTIS HC $3.00 CSCL 05B

Techniques, useful in transmitting and processing information, are discussed. In particular, restrictions of the law of conservation of energy on allowable forms of interaction Hamiltonians and optimum quantum measurement by extension of Hilbert space technique are discussed. E.H.W.

N74-14890*# Stanford Univ., Calif. Center for Radar Astronomy.

OPTIMIZATION IN THE DESIGN OF A 12 GIGAHERTZ LOW COST GROUND RECEIVING SYSTEM FOR BROADCAST SATELLITES. VOLUME 1: SYSTEM DESIGN, PERFORMANCE, AND COST ANALYSIS Final Report

K. Ohkubo, C. C. Han, J. Albernaz, J. M. Janky, and B. B. Lusignan 15 Oct. 1972 171 p refs

(Contract NAS3-14362)

(NASA-CR-121184-Vol-1) Avail: NTIS HC $10.75 CSCL 17B

The technical and economical feasibility of using the 12 GHz band for broadcasting from satellites were examined. Among the assigned frequency bands for broadcast satellites, the 12 GHz band system offers the most channels. It also has the least interference on and from the terrestrial communication links. The system design and analysis are carried out on the basis of a decision analysis model. Technical difficulties in achieving low-cost 12 GHz ground receivers are solved by making use of a die cast aluminum packaging, a hybrid integrated circuit mixer, a cavity stabilized Gunn oscillator and other state-of-the-art microwave technologies for the receiver front-end. A working model was designed and tested, which used frequency modulation. A final design for the 2.6 GHz system ground receiver is also presented. The cost of the ground-terminal was analyzed and minimized for a given figure-of-merit (a ratio of receiving antenna gain to receiver system noise temperature). The results were used to analyze the performance and cost of the whole satellite system. Author

N74-14891*# Stanford Univ., Calif. Center for Radar Astronomy.

OPTIMIZATION IN THE DESIGN OF A 12 GIGAHERTZ LOW COST GROUND RECEIVING SYSTEM FOR BROADCAST SATELLITES. VOLUME 2: ANTENNA SYSTEM AND INTERFERENCE Final Report

K. Ohkubo, C. C. Han, J. Albernaz, J. M. Janky, and B. B. Lusignan 15 Oct. 1972 198 p refs

(Contract NAS3-14362)

(NASA-CR-121184-Vol-2; SU-SEL-72-043-Vol-2) Avail: NTIS HC $12.00 CSCL 17B

The antenna characteristics are analyzed of a low cost mass-producible ground station to be used in broadcast satellite systems. It is found that a prime focus antenna is sufficient for a low-cost but not a low noise system. For the antenna feed waveguide systems are the best choice for the 12 GHz band, while printed-element systems are recommended for the 2.6 GHz band. Zoned reflectors are analyzed and appear to be attractive from the standpoint of cost. However, these reflectors suffer a gain reduction of about one db and a possible increase in sidelobe levels. The off-axis gain of a non-auto-tracking station can be optimized by establishing a special illumination function at the reflector aperture. A step-feed tracking system is proposed to provide automatic procedures for searching for peak signal from a geostationary satellite. This system uses integrated circuitry and therefore results in cost saving under mass production. It is estimated that a complete step-track system would cost only $512 for a production quantity of 1000 units per year. Author

N74-14892*# Stanford Univ., Calif. Inst. for Communication Research.

TESTING AND ASSESSMENT OF CO-CHANNEL VIDEO INTERFERENCE ON TELEVISION, ATTACHMENT 1 Final Report

Richard H. Miller May 1972 49 p refs

(Contract NAS3-14362)

(NASA-CR-121184-Att-1) Avail: NTIS HC $4.50 CSCL 09F

Subjective assessment tests of co-channel interference on an amplitude modulated television system were run to determine the viewers' awareness of interference that exists when an FM television system is operated at the game frequencies as an AM-VSB television station. Results of the tests, conducted for an interfering FM signal on AM reception,are focused toward the evaluation of frequency-sharing between an FM transmitter in synchronous orbit and an AM-VSB television system on earth. The analysis of the experimental design and protocols used in previous testing indicate a new formula for further experimental procedures of this type. Author

N74-14893# Collins Radio Co., Dallas, Tex.

NEW CONCEPT AIR/GROUND COMMUNICATIONS SYSTEM Final Report on Phase 2 development, Sep. 1968 - Sep. 1971

Oct. 1973 358 p

(Contract DOT-FA67WA-1733)

(FAA-RD-71-62) Avail: NTIS HC $20.00

The detail design, assembly, and test of an experimental air/ground communications test bed are reported. This test bed will provide a vehicle to allow evaluation of the air/ground communication systems concepts developed in Phase I of the study. It will also yield an evaluation of the hardware possessing the characteristics required for the concepts and time-frame being considered. The test bed as described in this report was first assembled in Dallas, Texas. The entire system was tested to ensure that all equipment and software was operational. Acceptance tests were conducted for FAA representatives and the system was formally accepted on August 10, 1970. The system was then dismantled and shipped to the National Aviation Facilities Experimental Center near Atlantic City, New Jersey. After assembly there, the system was tested again for proper operation. The test bed consists of a central processor unit, audio switching and control units, digital calling equipment, and diagnostic teletypewriters mounted in a trailer outside of Building 149. Five fast-tuned VHF transceivers and audio switching units are located at the remote RCAG site and four controller interface devices are located inside Building 149.

Author

N74-14894*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

RADIOCOMMUNICATIONS FOR METEOROLOGICAL SATELLITE SYSTEMS

Barbara A. Walton Dec. 1973 42 p refs

(NASA-TM-X-70565; X-120-73-388) Avail: NTIS HC $4.25 CSCL 17B

A general overview is presented of the spectrum utilization and frequency requirements of present and planned U.S. meteorological satellite programs. Meteorological sensing techniques are discussed along with the Tiros operational system, the ITOS operational satellite, the Nimbus satellite, synchronous meteorological satellites, and future carriers of meteorological payloads. A summary of meteorological satellite flights from 1960 - 1969 is included. K.M.M.

N74-14895*# IIT Research Inst., Chicago, Ill.

FEASIBILITY MODEL OF A HIGH RELIABILITY FIVE-YEAR TAPE TRANSPORT, VOLUME 2 Technical Report, 5 Jan.

1972 - 5 Nov. 1973
R. L. Eshleman, A. P. Meyers, W. A. Davidson, R. C. Gortowski, and M. E. Anderson Oct. 1973 93 p
(Contract NAS5-21692; IITRI Proj. E6225)
(NASA-CR-132898) Avail: NTIS HC $6.75 CSCL 05B

Analysis of the design features of the modularized tape transport renders a life expectancy in excess of five years. Tests performed on the tape transport were directed toward determining its performance capability. These tests revealed that the tape jitter and skew are in the range achieved by high quality digital tape transports. Guidance of the tape in the lateral sense by the use of the two hybrid crowned rollers proved to be excellent. Tracking was maintained within less than one thousandth inch (approximately 2 micrometers). The guidance capability demonstrated makes possible the achievement of the performance objective of 7.2 x 10 to the 9th power storage capability employing 1500 ft. of one inch wide tape with a packing density of 5,000 bits per inch per track on 80 tracks. Also, the machine showed excellent characteristics operating over a wide range of tape speeds. The basic design concept lends itself to growth and adaptation to a wide range of recorder requirements. Author

N74-14896*# Computer Sciences Corp., Falls Church, Va.
FREQUENCY MODULATION TELEVISION ANALYSIS: DISTORTION ANALYSIS Final Report, Sep. 1972 - Nov. 1973
William H. Hodge and Wing H. Wong 26 Nov. 1973 258 p refs
(Contract NAS5-21872)
(NASA-CR-132895; Rept-3007-2) Avail: NTIS HC $15.00 CSCL 09F

Computer simulation is used to calculate the time-domain waveform of standard T-pulse-and-bar test signal distorted in passing through an FM television system. The simulator includes flat or preemphasized systems and requires specification of the RF predetection filter characteristics. The predetection filters are modeled with frequency-symmetric Chebyshev (0.1-db ripple) and Butterworth filters. The computer was used to calculate distorted output signals for sixty-four different specified systems, and the output waveforms are plotted for all sixty-four. Comparison of the plotted graphs indicates that a Chebyshev predetection filter of four poles causes slightly more signal distortion than a corresponding Butterworth filter and the signal distortion increases as the number of poles increases. An increase in the peak deviation also increases signal distortion. Distortion also increases with the addition of preemphasis. Author

N74-14897*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MOTION OF METRIC TYPE 4 RADIO SOURCES AND ITS RELATION TO SHOCK WAVES RESPONSIBLE FOR TYPE 2 RADIO BURSTS
Kunitomo Sakurai (Md. Univ.) Dec. 1973 12 p refs
(NASA-TM-X-70557; X-690-73-367) Avail: NTIS HC $3.00 CSCL 20N

The relation of the motion of type 4mA sources with shock waves responsible for type 2 bursts were considered using the observed data for these two radio sources. The difference of the emission mechanism between type 2 and type 4mA bursts suggest that the moving speed of the shock waves mentioned above is not necessarily equal to the metric type 4 sources. By analyzing the observed data on the speeds for both type 2 and type 4 sources., it was found that type 4 bursts decelerate and often cease to move in the solar envelop and that type 2 sources move at higher speeds than type 4 sources. Author

N74-14898*# Scientific Translation Service, Santa Barbara, Calif.
CIRCULAR ENERGY VORTEX IN THE NEAR FIELD OF A DIRECTIONAL ANTENNA
F. Landstorfer, H. Heinke, and G. Niedermair Washington NASA Jan. 1974 16 p refs Transl. into ENGLISH from NTZ-Nachrtech. Z. (Brunswick), v. 25, no. 12, Dec. 1972 p 537-541
(Contract NASw-2483)
(NASA-TT-F-14754) Avail: NTIS HC $3.00 CSCL 17B

The energy vortex of a hemispherical antenna was measured. The antenna consists of a 27 cm diameter dielectric hemisphere with a radiator on the surface and a conducting base plane. This results in a measurement range in the range 400-1250 MHz. Line of constant phase, constant amplitude were measured, and energy streamlines were determined. Author

N74-14899# Ceskoslovenska Akademie Ved, Ondrejov. Astronomical Inst.
SOLAR RADIO DATA, APRIL 1973
Apr. 1973 14 p
Avail: NTIS HC $3.00

Solar radio noise was measured at 810 to 70 MHz over Czechoslovakia. The medians of the base level flux are given for 3 hr periods. Data on solar flares and noise storms are also tabulated. J.A.M.

N74-14900# Ceskoslovenska Akademie Ved, Ondrejov. Astronomical Inst.
SOLAR RADIO DATA, FEBRUARY - MARCH 1973
Mar. 1973 20 p
Avail: NTIS HC $3.00
For abstract, see N74-14899.

N74-14901# Ceskoslovenska Akademie Ved, Ondrejov. Astronomical Inst.
SOLAR RADIO DATA, MAY 1973
May 1973 12 p
Avail: NTIS HC $3.00
For abstract, see N74-14899.

N74-14902# Ceskoslovenska Akademie Ved, Ondrejov. Astronomical Inst.
SOLAR RADIO DATA, JULY 1973
Jul. 1973 9 p
Avail: NTIS HC $3.00
For abstract, see N74-14899.

N74-14903# Ceskoslovenska Akademie Ved, Ondrejov. Astronomical Inst.
SOLAR RADIO DATA, JUNE 1973
Jun. 1973 11 p
Avail: NTIS HC $3.00
For abstract, see N74-14899.

N74-14904# Ceskoslovenska Akademie Ved, Ondrejov. Astronomical Inst.
SOLAR RADIO DATA, SEPTEMBER 1973
Sep. 1973 12 p
Avail: NTIS HC $3.00
For abstract, see N74-14899.

N74-14905# Ceskoslovenska Akademie Ved, Ondrejov. Astronomical Inst.
SOLAR RADIO DATA, OCTOBER 1973
Oct. 1973 11 p
Avail: NTIS HC $3.00
For abstract, see N74-14899.

N74-14906# Minnesota Univ., St. Paul. Dept. of Ecology and Behavioral Biology.
RAPTOR CONSERVATION AND MANAGEMENT APPLICATIONS OF BIO-TELEMETRY STUDIES FROM CEDAR CREEK NATURAL HISTORY AREA
M. R. Fuller, T. H. Nicholls, and J. R. Tester [1973] 16 p refs Presented at Conf. on Raptor Conserv. Tech., Ft. Collins, Colo., 22-25 Mar. 1973 Sponsored by AEC and NIH
(COO-1332-87; Conf-730340-1) Avail: NTIS HC $3.00

The habitat preference and intensity of use were determined for the Barred Owl to aid the conservationists in his decision making for managing wildlife habitats. It is shown that the manager must strive for conditions that allow for the development of spatial-temporal relationship among species. F.O.S.

N74-14907# Minnesota Univ., St. Paul. Dept. of Ecology and Behavioral Biology.
AUTOMATIC RADIO TRACKING SYSTEM FOR BIOTELEMETRY
M. R. Fuller and J. R. Tester 1973 4 p Presented at Conf. on Raptor Conservation Tech., Ft. Collins, Colo., 22-25 Mar. 1973 Sponsored by AEC

(COO-1332-89; Conf-730340-3) Avail: NTIS HC $3.00

An automatic radio tracking system designed to provide quantitative data on animal behavior under natural conditions is described which is capable of obtaining 1920 locations per animal per day. It is shown that the radio tracking data on raptors have resulted in a better understanding of the behavioral and ecological aspects of habit at use, home range size, territoriality, movement patterns, spacing, and predator-prey interaction. F.O.S.

N74-14908# Minnesota Univ., St. Paul. Dept. of Ecology and Behavioral Biology.

ACCURACY AND OPTIMIZATION OF TRACKING SYSTEMS Ph.D. Thesis

R. L. Sanford Aug. 1973 225 p refs

(Contract AT(11-1)-1332; Grant GM-01779)

(COO-1332-94) Avail: NTIS HC $13.25

A decision theoretic model designed to aid in the creation, development, and critical evaluation of automatic tracking systems is presented. This model is specifically designed for tracking systems which use two directional Yagi antennas to estimate the unknown location of a radio carrying animal by mathematical triangulation. The approach taken is stochastic in nature and involves the quantification of a tracking system's performance by a probabilistic treatment of radio wave propagation as well as a probabilistic treatment of the propagation of errors during bearing determination and position estimation. Estimation results basic to extending this approach to three tower tracking systems are given. The usefulness and flexibility of the two tower tracking system model is demonstrated by considering possible improvements in the Cedar Creek Tracking System.

Author (NSA)

N74-14909# Admiralty Surface Weapons Establishment, Portsmouth (England).

DEGRADATION OF COMMUNICATION ON AWF WHIP ANTENNAS IN AN ICING ENVIRONMENT AT SEA

R. Kilgour and W. K. Brown Jan. 1973 65 p refs

(TR-73-4; BR36594) Avail: NTIS HC $5.25

Atmospheric conditions conducive to icing at sea are outlined, and the probable nature of the resulting ice accretion is discussed. The effects of saline ice accretion on communication efficiency of whip antennas, typically used in current Fishery Protection vessels, are assessed from measurements made on a representative antenna in the BAC Climatic Chamber in a simulated moderately severe icing environment. Communication efficiency is shown to be badly degraded by virtue of power dissipation in ice bridging the base insulator, and by the creaton of an appreciable mismatch between transmitter and antenna. Some palliative measures are discussed and recommendations made to alleviate the situation. Author (ESRO)

N74-14910# Naval Air Development Center, Warminster, Pa. Aero-Electronic Technology Dept.

AN INTRODUCTION TO ADAPTIVE BEAMFORMING

W. Norr 27 Jun. 1973 54 p refs

(AD-767938; NADC-73056-20) Avail: NTIS CSCL 17/1

The purpose of the report is to describe and compare the various algorithms used in ABF (Adaptive Beamforming). It was written primarily to disseminate information among those who will require a working knowledge of ABF. Various techniques of matrix inversion, gradient search, and eigenvalue decomposition of the cross-spectral matrix are discussed. An introduction to beamforming is given in matrix notation, and performance criteria are stated and compared. Although the detailed derivations for the algorithms are omitted, the block diagrams, assumptions, limitations, conclusions, and all available information are given.

Author (GRA)

N74-14911# IIT Research Inst., Chicago, Ill.

STUDY OF CONCEPTS FOR NAVY TACTICAL VOICE RADIO COMMUNICATIONS Final Report

Robert V. Janc, Barry I. Marks, and Nickolas T. Thomopulos Oct. 1973 333 p refs

(Contract N00014-70-C-0375; RF0180206)

(AD-768320; IITRI-E6174-42) Avail: NTIS CSCL 17/2

Various reports have indicated that changes are needed in the existing Naval tactical voice radio networks to improve current performance and to provide future operational requirements. The existing networks are of the dedicated type and the network supervisory control functions are carried out by voice transmission. It is in these two areas that changes are being considered; specificially, switched networks to replace the dedicated ones and electronic hardware to perform the network supervisory control functions. The basic objective of this program was to develop an analytical methodology that could be used to quantitatively predict the performance of the tactical voice radio networks for a range of alternatives that encompass the areas of switched networks and electronic control. This report describes the program in four levels of detail; namely, a brief executive summary, a broad nonmathematical overview, a more detailed narrative with mathematical summaries and a complete mathematical documentation of the results produced. Author (GRA)

N74-14912# Airborne Instruments Lab., Deer Park, N.Y.

ELECTRONICALLY TUNED LINEAR VHF PRESELECTOR Final Report, Nov. 1971 - Jul. 1973

E. Markard Oct. 1973 99 p refs

(Contract DAAB07-72-C-0068)

(AD-768217; AIL-7775-F; ECOM-0068-F) Avail: NTIS CSCL 17/2

An investigation was made of digitally controlled tuning elements applicable to small, low-loss VHF preselectors. It summarizes the evaluation of ferrites and solid-state devices (primarily PIN diodes) for this application, and describes the performance of a digitally tunable, two resonator prototype filter incorporating PIN diode tuners. The prototype clearly demonstrated the feasibility of digitally tuned preselectors and indicated the following potential capabilities: High-speed digital tuning across the entire 30 to 80 MHz frequency range without the need for band-switching; Insertion loss on the order of 2 db; Inherent frequency stability; Low average bias power requirement approximately 63 mW; RF power operation to at least 10 watts with second harmonic 80 db below the fundamental; and Small size and lightweight, 8 cubic inches and 7 ounces, respectively.

Author (GRA)

N74-14913# ITT Electro-Physics Labs., Inc., Columbia, Md.

TEAL WING OWR PROGRAM Semiannual Technical Report, period ending 30 Sep. 1973

Robert B. Wagner Oct. 1973 48 p refs

(Contract N00014-72-C-0441; ARPA Order 2073)

(AD-768914; ITT-EPL-241) Avail: NTIS CSCL 17/2

Progress to date consists of the following: two of the three seasonal measurements of at-sea natural noise were made and partially analyzed; the suitability of existing, fleet-deployed antennas for the intended class of service was investigated; and, the channel characterization experiments, performed during August 1973 between Cape Cod and two points on the coast of Maine (100 and 220 nm) are described under the following categories: equipment, physical set-up, and some preliminary data results which indicate that dispersion is insignificant on the surface-wave mode for the environmental conditions prevailing during the test period. GRA

N74-14914# Rome Air Development Center, Griffiss AFB, N.Y.

DETECTION PERFORMANCE OF THE AN/TPN-19 PAR (PRECISION APPROACH RADAR)

Vincent C. Vannicola Aug. 1973 117 p refs

(AD-768330; RADC-TR-72-238) Avail: NTIS CSCL 17/9

The purpose of the report is to determine the receiver operating characteristics of the AN/TPN-19 PAR Air Force radar in some of its operating modes. The scan mode and the coherent MTI (Moving Target Indicator) mode will be considered for the case when the received target signal is corrupted by white Gaussian noise only. The MTI loss (the increase in signal-to-noise ratio required for the same detection performance when switching from the scan mode to the MTI mode) is also determined and discussed. Methods for improving the MTI performance are given and evaluated. Author (GRA)

N74-14915# Pattern Analysis and Recognition Corp., Rome, N.Y.

ORTHONORMAL EXPANSION STUDY FOR WAVEFORM PROCESSING SYSTEM (WPS) Technical Report, Feb. 1972 - Feb. 1973

Donald H. Foley Jul. 1973 28 p refs
(Contract F30602-72-C-0193)
(AD-767276; PAR-73-15RADC-TR-73-168) Avail: NTIS CSCL 09/4

The report discusses the results of an orthonormal waveform expansion study conducted by Pattern Analysis and Recognition Corporation (PAR) during the early phase of contract F30602-72-C-0193. The purpose of the study was the determination of which orthonormal expansions and associated displays would be most useful to the Waveform Processing System (WPS) user. Author (GRA)

N74-14916# Michigan Univ., Ann Arbor. Radiation Lab.
A PROGRAM INCORPORATING DIFFRACTION FOR THE COMPUTATION OF RADAR CROSS SECTION
Eugene F. Knott and Thomas B. A. Senior Jun. 1973 53 p refs
(Contract F19628-73-C-0126; AF Proj. 5635)
(AD-768443; Rept-011758-2-T; AFCRL-TR-73-0351; SR-2) Avail: NTIS CSCL 17/9

A computer program is described that calculates the radar backscattering behavior of metallic roll symmetric bodies having one or more ring discontinuities in surface slope. The field diffracted by each surface singularity is represented by a line integral of equivalent electric and magnetic currents. The scattered field can be expressed as an integral of the physical optics currents existing over all non-diffracting portions of the surface and the equivalent currents at the singularities. However, since the equivalent currents themselves contain a physical optics component, the original currents must be modified in order to remove it. The predictions of the computer program are compared with experimental data for cones and for a typical aerospace vehicle. Though the program is almost as efficient as one using physical optics alone, the results obtained are markedly superior. Author (GRA)

N74-14917# Signatron, Inc., Lexington, Mass.
ADAPTIVE DATA TRANSMISSION STUDY Final Report, Sep. 1972 - Jun. 1973
Peter Monsen and Steven H. Richman Aug. 1973 217 p refs
(Contract F30602-73-C-0023; AF Proj. 4519)
(AD-768999; SIG-A-148; RADC-TR-73-268) Avail: NTIS CSCL 09/4

A study was completed of feasible techniques for transmission of up to 13 megabits/second over a tropospheric-scatter channel. The techniques identified for this study were frequency-division-multiplex/frequency modulation, parallel processing of subchannel data, transmitter time-gating, receiver time-gating, coding techniques, maximum likelihood detection including the Viterbi algorithm, and adaptive equalization. The investigation considered a realistic channel model and terminal equipment constraints in a determination of technique performance, adaptability to a changing multipath channel, and implementability. A practical realization of a feedback equalizer was found to have superior performance relative to all other practical receivers considered. Moreover, the equalizer performance was within 1 db of a bound for an ideal maximum likelihood decoder. (Modified author abstract) GRA

N74-14918# Syracuse Univ., N.Y. Dept. of Electrical and Computer Engineering.
GROUND-TO-AIR COMMUNICATION PERFORMANCE MONITOR
Jose Perini and Dale Parfitt Aug. 1973 32 p
(Contract F30602-72-C-0360; AF Proj. 9567)
(AD-768977; RADC-TR-73-252) Avail: NTIS CSCL 17/2

The Air Force Communications Service (AFCS) has expressed a need for a ground-to-air performance monitor to be used in conjunction with their control tower communications system. The monitor is to be installed in the transmitter-receiver communications link and should provide a quick and simple means of determining the status of the system. The report is concerned with the design and development of such a monitor to be used at Richards-Gebaur Air Force Base, Kansas City, Missouri.

N74-14919# Syracuse Univ., N.Y. Dept. of Electrical and Computer Engineering.
COMPUTATIONAL METHODS FOR ANTENNA PATTERN SYNTHESIS
Joseph R. Mautz and Roger F. Harrington Aug. 1973 47 p refs
(Contract F19628-73-C-0047)
(AD-768969; AFCRL-TR-73-0500; SR-2) Avail: NTIS CSCL 09/5

Some general numerical methods for antenna pattern synthesis, with and without constraints, are developed in this report. Particular cases considered are (1) field pattern specified in amplitude and phase, (2) field pattern specified in amplitude only, (3) these two cases with a constraint on the source quality factor. Both the source and the field are discretized at the beginning, and the methods of finite dimentional vector spaces are used for the computations. The theory is general, but is applied only to point sources arbitrarily distributed in a plane, and to pattern synthesis in this plane. Some numerical examples are given for ten sources approximately equispaced on one-half of an ellipse, with the desired field pattern chosen to be the cosecant phi pattern in the first quadrant. Author (GRA)

08 COMPUTERS

Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

N74-14920* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ADAPTIVE VOTING COMPUTER SYSTEM Patent
Louis J. Koczela (Autonetics, Anaheim, Calif.) and Donald S. Wilgus, inventors (to NASA) (Autonetics, Anaheim, Calif.) Issued 1 Jan. 1974 34 p Filed 25 Feb. 1972 Supersedes N72-21206 (10 - 12 p 1581) Sponsored by NASA
(NASA-Case-MSC-13932-1; US-Patent-3,783,250; US-Patent-Appl-SN-229354; US-Patent-Class-235-153AK) Avail: US Patent Office CSCL 09B

A computer system is reported that uses adaptive voting to tolerate failures and operates in a fail-operational, fail-safe manner. Each of four computers is individually connected to one of four external input/output (I/O) busses which interface with external subsystems. Each computer is connected to receive input data and commands from the other three computers and to furnish output data commands to the other three computers. An adaptive control apparatus including a voter-comparator-switch (VCS) is provided for each computer to receive signals from each of the computers and permits adaptive voting among the computers to permit the fail-operational, fail-safe operation.
Official Gazette of the U.S. Patent Office

N74-14921*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MISSION AND DATA OPERATIONS IBM 360 USER'S GUIDE
Jack Balakirsky Jul. 1973 509 p refs Prepared in cooperation with Computer Sciences Corp., Silver Spring, Md.
(NASA-TM-X-69900) Avail: NTIS HC $27.50 CSCL 09B

The M and DO computer systems are introduced and supplemented. The hardware and software status is discussed, along with standard processors and user libraries. Data management techniques are presented, as well as machine independence, debugging facilities, and overlay considerations. J.A.M.

N74-14922 RAND Corp., Santa Monica, Calif.
ENHANCING COMPUTER SYSTEM SECURITY
Dennis Hollingworth Aug. 1973 21 p refs
(P-5064) Avail: NTIS HC $3.25

One of the more significant problems in the information processing industry today is that of protecting sensitive computerized information from unauthorized access. As yet, no technique suggested or implemented appears to offer a complete solution to the problem. An attractive and cost-effective partial solution may reside in a different approach to the problem-

of the system/penetrator inter-action is altered via introduction of counter-penetration elements into the system hardware and software. Author

N74-14923# Joint Publications Research Service, Arlington, Va.
PHILOSOPHICAL MEANING OF THE PROBLEM OF NATURAL AND ARTIFICIAL INTELLIGENCE
P. K. Anokhin 7 Jan. 1974 20 p refs Transl. into ENGLISH from Vopr. Filosofii (Moscow), no. 6, 1973 P 83-97
(JPRS-60916) Avail: NTIS HC $3.00

The report contains data on the investigation of the typical features of natural intellect and the use of the results of such work to construct a model of artificial intellect. Author

N74-14924# Joint Publications Research Service, Arlington, Va.
MODELS OF A UNIFIED SYSTEM OF ELECTRONIC COMPUTERS
Yu. A. Shymkov and R. I. Gogunov 4 Jan. 1974 21 p Transl. into ENGLISH from Prib. Sist. Upr. (Moscow), no. 10, 1973 p 1-5
(JPRS-60906) Avail: NTIS HC $3.25

Specific configurations are presented of models of unified systems of computers to show the possibilities and certain technical characteristics of the peripheral equipment manufactured in the cooperating nations. Author

N74-14925# Japan Broadcasting Corp., Tokyo.
IMAGES: INTERACTIVE MONTAGE AND ANIMATION GENERATING SYSTEM
Takao Omata, Junnosuke Kutsuzawa, Hiroshi Yasuda, and Kenji Kira Aug. 1973 10 p
(NHK-Labs-Note-168) Avail: NTIS HC $3.00

An experimental computer animation system IMAGES (Interactive Montage and Animation Generating System) was developed which generates a series of animated pictures in three-dimensional space and displays them on a CRT. In order to simplify programming and to reduce the operator's load, IMAGES has three separate processing program blocks; motion generation, combination, and playback, just like the processing steps in hand-made animation film production. All of the commands enter into the system interactively through the keyboards and the light pen. Author

N74-14926# RAND Corp., Santa Monica, Calif.
COMPUTERS AND SOCIETY: THE TECHNOLOGICAL SETTING
Willis H. Ware Oct. 1973 33 p refs Presented at Conf. on Computers, Soc. and Law, Stanford, Calif., 25-26 Jun. 1973
(P-5094) Avail: NTIS HC $3.75

Futuristic predictions for the computer industry are based on electronic component development and exploitation of electronic capability. Replacement of the magnetic core by LSI storage devices, bubble memories, and amorphous films imprinted by laser technique increases operational speed and reduces computer size and cost significantly. Projected is a tremendeous growth for the data processing industry and incorporation of computer technology in a person's home. Conceptual and social problems of a widespread computer industry include the protection of data banks to conserve the privacy and anonymity of the individual. G.G.

N74-14927# RAND Corp., Santa Monica, Calif.
MEASURES OF EFFECTIVENESS AND THE TALLY/TOTEM METHODOLOGY
P. M. Dadant Jul. 1973 29 p Presented at the 31st Meeting of the Mil. Operations Res. Soc., Jun. 1973
(P-5062) Avail: NTIS HC $3.50

Measures of effectiveness are used to compare tactical war fighting systems using air power. The air power system is embedded in an overall air ground battle model and the weather factor feeds into both the air and the ground models. Computerized operation of the two sided expected value model considers ground attack sorties and the feedback movement of ground units in an attrition computation that varies with targeting and applies the survivers to the targets. A trade of area on the ground for remaining war fighting capability and the time taken to reach given objectives on the ground constitute the most meaningful measures in the model. G.G.

N74-14928# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computing.
ESTIMATING THE EXECUTION SPEED OF AN ALGOL PROGRAM
B. A. Wichmann Jun. 1973 24 p refs
(NPL-NAC-38) Avail: NTIS HC $3.25

A simple method involving weight assignment for estimating the speed of an ALGOL program is given. It can be used as a programming aid in the construction of efficient algorithms. ESRO

N74-14929# Consiglio Nazionale delle Ricerche, Rome (Italy). Lab. di Ricerca e Tecnologia per lo Studio del Plasma nello Spazio.
INPUT-OUTPUT ROUTINES IN BASIC LANGUAGE FOR THE HP2116B COMPUTER [SISTEMA DI INGRESSO-USCITA IN LINGUAGGIO BASIC PER IL CALCOLATORE HP21-16B]
Franco Palutan Feb. 1973 35 p refs In ITALIAN
(LPS-73-6) Avail: NTIS HC $3.75

Input output routines in BASIC for use with the HP 2116B computer are presented. The limitations of BASIC to teletype conversational mode were overcome to permit its use with other peripheral equipment. The I/O sequences and deck card structure are detailed. ESRO

N74-14930# Centre National de la Recherche Scientifique, Toulouse (France). Lab. d'Automatique et d'Analyse des Systemes.
TEKTRONIX 4010-1 VISUAL DISPLAY CONSOLE COUPLING TO THE CII 90-10 COMPUTER [COUPLAGE D'UNE CONSOLE DE VISUALISATION TEKTRONIX 4010-1 AVEC LE CALCULATEUR CII 90-10]
M. Benoit and D. Ribot Oct. 1973 33 p In FRENCH
(LAAS-SIS-73-I-28) Avail: NTIS HC $3.75

The coupling between the Tektronix 4010-1 visual display console and the CII 90-10 computer is presented. The interface hardware required is dealt with. The real time operation and programming associated with the EVARISTE monitor are described. ESRO

N74-14931# Stanford Univ., Calif. Dept. of Computer Science.
A CORNER FINDER FOR VISUAL FEEDBACK
W. A. Perkins and T. O. Binford Aug. 1973 64 p refs
(ARPA Order 457)
(AD-767332; SU-STAN-CS-73-386; AIM-214) Avail: NTIS CSCL 09/2

In visual-feedback work often a model of an object and its approximate location are known and it is only necessary to determine its location and orientation more accurately. The purpose of the program described herein is to provide such information for the case in which the model is an edge or corner. Given a model of a line or a corner with two or three edges, the program searches a TV window of arbitrary size looking for one or all corners which match the model. A model-driven program directs the search. It calls on another program to find all lines inside the window. Then it looks at these lines and eliminates lines which cannot match any of the model lines. It next calls on a program to form vertices and then checks for a matching vertex. If this simple procedure fails, the model-driver has two backup procedures. First it works with the lines that it has and tries to form a matching vertex (corner). If this fails, it matches parts of the model with vertices and lines that are present and then takes a careful look in a small region in which it expects to find a missing line. The program often finds weak contrast edges in this manner. Lines are found by a global method after the entire window has been scanned with the Hueckel edge operator. Author (GRA)

N74-14932# Stanford Univ., Calif. Dept. of Computer Science.
AXIOMATIC APPROACH TO TOTAL CORRECTNESS OF PROGRAMS
Zohar Manna and Amir Pnueli Jul. 1973 29 p refs

(Contract DAHC15-73-C-0435; ARPA Order 457)
(AD-767335; SU-STAN-CS-73-382; AIM-210) Avail: NTIS CSCL 09/2

The authors present an axiomatic approach which enables one to prove by formal methods that his program is totally correct (i.e., it terminates and is logically correct -- does what it is supposed to do). The approach is similar to Hoare's approach for proving that a program is partially correct (i.e., that whenever it terminates it produces correct results). The extension to Hoare's method lies in the possibility of proving correctness and termination at once, and in the enlarged scope of properties that can be proved by it. Author (GRA)

N74-14933# Stanford Univ., Calif. Dept. of Computer Science.
SCENE ANALYSIS USING A SEMANTIC BASE FOR REGION GROWING
Jun. 1973 136 p refs
(Contract ARPA SD-183; ARPA Order 457)
(AD-767695; SU-STAN-CS-73-380; AIM-209) Avail: NTIS CSCL 09/2

The problem of breaking an image into meaningful regions is considered. A probabilistic semantic basis is effectively integrated with the segmentation process, providing various decision criteria. Learning facilities are provided for interactively generating the Bayesian probabilistic basis. A programming system which is based on these ideas and its successful application to two problem domains are described. Author (GRA)

N74-14934# Adaptronics, Inc., McLean, Va.
THE MUCCIARDI-GOSE CLUSTERING ALGORITHM AND ITS APPLICATIONS IN AUTOMATIC PATTERN RECOGNITION Final Report, 15 Mar. - 15 Nov. 1972
Anthony N. Mucciardi Jul. 1973 76 p refs
(Contract F33615-72-C-1491; AF Proj. 7233)
(AD-767273; Rept-662-FTR; AMRL-TR-73-31) Avail: NTIS CSCL 09/2

A procedure known as the Mucciardi-Gose clustering algorithm, CLUSTR, for determining the geometrical or statistical relationships among groups of N-dimensional vectors is presented. The vectors may be thought of as samples from some complex process that is under study. For example, the process may be aerial reconnaissance photography, and the vectors may be digital representations of the pictures. In this example, the geometrical or statistical relationships between the pictures, some part of the pictures, or some derivative of the pictures, must be known before an automatic analysis of the content of the pictures can be performed by machine. The CLUSTR algorithm provides a means of determining these relationships. A general discussion of clustering algorithms is given; the particular advantages of the Mucciardi-Gose procedure are described. The mathematical basis for, and the program structure of, the CLUSTR algorithm are presented in detail. Topics covered include: initial cluster hypervolume estimates, birth and growth rate processes of clusters, estimation of cluster hypervolume overlap. Specific instructions for use of the programs and for interpretation of the results are provided. Author (GRA)

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N74-14935* United Aircraft Corp., West Palm Beach, Fla.
INHERENT REDUNDACY ELECTRIC HEATER Patent
Bruce H. Kernodle, inventor (to NASA) Issued 8 May 1973 4 p Filed 30 Mar. 1972 Supersedes N72-22221 (10 - 13, p 1719) Sponsored by NASA
(NASA-Case-MFS-21462-1; US-Patent-3,732,397; US-Patent-Appl-SN-239576; US-Patent-Class-219-477; US-Patent-Class-219-539; US-Patent-Class-338-320) Avail: US Patent Office CSCL 09E

A cross-wound electrical heater comprising two resistance coils wound together with opposite pitches electrically connected at their crossing points, is reported. Each element is supplied by a separate power supply of the same magnitude, and each power supply is isolated from reverse currents by a diode. Failure of one of the windings results in only a moderate change in output power. Official Gazette of the U.S. Patent Office

N74-14936 British Library Lending Div., Boston Spa (England).
CALCULATION OF NON-LINEAR DISTORTION OF A WIDEBAND AMPLIFIER NEAR THE OVERLOAD POINT
Klaus Gruenenwald 8 Nov. 1973 15 p refs Transl. into ENGLISH from Frequenz (Berlin), v. 27, no. 4, 1973 p 92-97
(BLL-RDL-Trans-3017-(9022.81)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

The computation of nonlinear distortions of a wideband amplifier in the vicinity of the overload point is reported. These distortions are due to amplitude clipping of the wideband signal which, in close approximation, is considered noise. The resultant distortions are a function of the amount of the amplitude clipped, but they are largely independent of the type of amplitude clipping and the form of the useful spectrum. The computations carried out with the aid of an electronic computer agreed closely with noise measurements performed on implemented carrier systems. Author

N74-14937 British Library Lending Div., Boston Spa (England).
AN ATTEMPT TO ASSESS INTRINSICALLY SAFE CIRCUITS BY OVERVOLTAGE MEASUREMENT
B. Kolodziejski 5 Jul. 1973 21 p Transl. into ENGLISH from Zes. Probl. Gorn. (Warsaw), v. 9, no. 2, 1971 p 21-39
(BLL-SMRE-Trans-6232-(8313.4)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

The magnitude of overvoltage measured with the same circuit parameters (L,J) depends on the current breaking condition. In the conditions determined for an air cored inductance in the range of 0.01H - 1H, the overvoltage developed during breaking of the circuit with an igniting current, has a constant value of about 1000 V. On the other hand, the values corresponding to safe currents are about 500 V. For an iron cored inductance the magnitude of overvoltage depends on the corresponding inductance of the circuit as well as on the type of iron core. Assessment of the intrinsic safety on the basis of overvoltage measurement is possible only with circuits containing inductances without iron cores. Circuits containing iron cored inductance should be tested in an explosive mixture of a given gas using special apparatus. Author

N74-14938 British Library Lending Div., Boston Spa (England).
THEORY OF LINKED RESONANT CAVITIES
A. I. Akhiezer and G. Ya. Lyubarskii Aug. 1973 15 p refs Transl. into ENGLISH from Zh. Tekh. Fiz. (USSR), v. 24, no. 9, 1954 p 1697-1706
(BLL-RTS-8133) Avail: British Library Lending Div., Boston Spa, Engl.: £ 1.40; 3 BLL photocopy coupons

A solution is given for the problem of natural vibrations of a series of resonant cavities linked together by narrow slits in the metallic partitions separating them. Author

N74-14939* National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
FULL WAVE MODULATOR-DEMODULATOR AMPLIFIER APPARATUS Patent
James M. Black, inventor (to NASA) Issued 1 Jan. 1974 4 p Filed 13 Jul. 1971 Supersedes N72-15206 (10 - 06, p 0742)
(NASA-Case-FRC-10072-1; US-Patent-3,783,399; US-Patent-Appl-SN-162100; US-Patent-Class-330-9; US-Patent-Class-330-10; US-Patent-Class-330-35) Avail: US Patent Office CSCL 09E

A full-wave modulator-demodulator apparatus is described including an operational amplifier having a first input terminal coupled to a circuit input terminal, and a second input terminal alternately coupled to the circuit input terminal. A circuit is ground by a switching circuit responsive to a phase reference signal and the operational amplifier is alternately switched between a non-inverting mode and an inverting mode. The switching circuit

includes three field-effect transistors operatively associated to provide the desired switching function in response to an alternating reference signal of the same frequency as an AC input signal applied to the circuit input terminal.
Official Gazette of the U.S. Patent Office

N74-14940 Post Office Research Dept., London (England).
A FAMILY OF INDUCTORLESS OSCILLATORS DERIVED FROM GYRATOR CIRCUITS
A. J. Greaves 9 Jun. 1972 18 p refs
(Rept-290) Copyrignt. Avail: Issuing Activity

A family of inductorless oscillators derived from gyrator circuits is described. The oscillators each employ two differential-input integrated circuit operational amplifiers, together with resistors and capacitors. Alternative methods of providing regenerative feedback are outlined and amplitude stabilization is achieved by adding diodes. One of the oscillators was studied in detail and it was found that a sinusoidal output signal with amplitude greater than one volt peak-to-peak and harmonic distortion less than 0.1% was readily obtainable over the frequency range 0.1 Hz to 100 kHz. Author

N74-14941*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DIODE-QUAD BRIDGE CIRCUIT MEANS Patent Application
Dean R. Harrison and John Dimeff, inventors (to NASA) Filed 16 Jan. 1974 20 p
(NASA-Case-ARC-10364-2(B); US-Patent-Appl-SN-433968) Avail: NTIS HC $3.00 CSCL 09E

A diode-quad bridge transducer circuit is reported that produces an output signal which is proportional to a relationship between at least two of the impedance elements. As a discriminator circuit it provides an output signal that is proportional to the input signal frequency. NASA

N74-14942*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
POSITION DETERMINATION SYSTEMS Patent Application
Paul W. Shores, inventor (to NASA) Filed 28 Nov. 1973 17 p
(NASA-Case-MSC-12593-1; US-Patent-Appl-SN-419747) Avail: NTIS HC $3.00 CSCL 09A

Disclosed is a system for an orbital antenna which is operated at a synchronous altitude to scan an area of a celestial body. The orbiting antenna has scanning capabilities to determine the location of a ground based beacon or transmitter relative to a central surface location at a short time after activation of the beacon. The purpose of this system is to provide a means of determining the position of ground based beacons relative to a central location within seconds after activation of the beacon. Thus, rapid location of vehicles in distress such as ships at sea, auto wrecks, airplane crashes, or any other basic alarm function can be quickly located. NASA

N74-14943# Sandia Labs., Albuquerque, N.Mex.
LARGE SIGNAL S-PARAMETERS: MODELING AND RADIATION EFFECTS IN MICROWAVE POWER TRANSISTORS
E. D. Graham, Jr., R. J. Chaffin, and C. W. Gwyn 1973 13 p refs Presented at Microwave Semiconductor Devices, Circuits and Applications Conf., Ithaca, N. Y., 14 Aug. 1973 Sponsored by AEC
(SLA-73-5416; Conf-730828-2) Avail: NTIS HC $3.00

The concepts and techniques relevant to the large signal S-parameter characterization scheme are reviewed. Experimental results showing Class C circuit waveforms as well as preirradiation and postirradiation large signal S-parameter data are presented. An entirely new and highly accurate modeling technique for bipolar transistor circuit performance is introduced. The technique features the uses of the exact one-dimensional device analysis code with a circuit analysis code. The modeling requires a doping profile for the chip and a model for the transistor package. It provides a method both for optimizing the package parasitic elements for a transistor chip and for simulating the total device response in an RF circuit. The circuit simulation code was used to study microwave transistor response under conditions similar to those for which experimental data are presented. Excellent agreement between experiment and calculated results point into the usefulness of this technique. Author (NSA)

N74-14944# Atlantic Research Corp., Alexandria, Va. Advanced Programs Group.
METHODS OF MOMENTS APPLICATIONS. VOLUME 2: NEAR FIELDS OF THIN WIRE ANTENNAS Final Report, Jun. 1971 - Jan. 1973
A. T. Adams, Thomas E. Baldwin, Jr., Daniel E. Warren, and Ephraim Mendelovicz Aug. 1973 122 p refs Prepared in cooperation with Syracuse Univ., N. Y.
(Contracts F30602-71-C-0358; F30602-72-C-0360)
(AD-767909; RADC-TR-73-217-Vol-2) Avail: NTIS CSCL 09/5

The method of moments is applied to wire antenna near-field problems. A numerical method for the computation of near electric and magnetic fields of thin-wire antenna structures is described. Details of the method are included, together with examples of its application to various problems of engineering interest. Comparative studies of typical near-field problems indicate results to be accurate as close as the length of one subsection from the wire surface, or as close as 3 to 5 wire radii. Methods for checking near-field computations are described. The selective use of a Hertzian dipole model reduced computation time considerably (15/1) without sacrifice of accuracy. The near fields of a half-wave dipole and of arrays (broadside and endfire) are described in detail. The near fields of an array and resultant radiation hazards are significantly affected by mutuals. The near-field polarization ellipse is characterized. Author (GRA)

N74-14945# Naval Research Lab., Orlando, Fla. Underwater Sound Reference Div.
PROPOSAL FOR THE DEVELOPMENT OF UNDERWATER SOUND TRANSDUCERS UTILIZING MAGNETOSTRICTIVE RARE EARTH-IRON ALLOYS
Robert W. Timme and Norman C. Koon 15 Oct. 1973 11 p
(NRL Proj. S02-31)
(AD-767925; NRL-MR-2663) Avail: NTIS CSCL 09/1

An investigation of the use of magnetostrictive rare earth-iron alloys as active elements of underwater sound transducers is proposed. The primary objective of the program would be a transducer having an acoustic output or sensitivity equal to or greater than a piezoelectric transducer of similar size, a high resistance to shock, and performance stability with respect to time. Author (GRA)

N74-14946# Maryland Univ., College Park. Computer Science Center.
DIGITAL PICTURE PROCESSING: A GUIDE TO THE LITERATURE
Azriel Rosenfeld and Avinash C. Kak Sep. 1973 61 p refs Prepared in cooperation with Purdue Univ.
(Contract N00014-67-A-0239-0012)
(AD-767715) Avail: NTIS CSCL 09/2

The report consists of several parts of a forthcoming book on Digital Picture Processing, dealing with pictures and their computer representation, image enhancement, and picture matching. Author (GRA)

N74-14947# Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.
INVESTIGATION OF NOVEL HEAT REMOVAL TECHNIQUES FOR POWER TRANSISTORS Final Report, 15 Nov. 1971 - 15 Sep. 1973
M. A. Merrigan Sep. 1973 70 p refs
(Contract DAAB07-72-C-0021; DA Proj. 1S7-62705-A-056)
(AD-768216; FR-73-10-840; ECOM-0021-F) Avail: NTIS CSCL 09/1

The feasibility of new cooling methods for VHF power transistors capable of providing a reduction in junction temperature of 33%, compared to conventionally packaged devices was investigated. Design objective for the transistors are 25 watts CW power from a 28-volt supply with a minimum power gain of 6 db. The electrical characteristics of the devices are to be within 10% of conventional devices, the volume no more than 4 times, and the weight no more than 5 times that of equivalent hermetically sealed devices. Achievement of these objectives

was based on the application of heat pipe cooling techniques to the chip surface, within a standard TO-package. The conclusions to be drawn from the program are that the cooling method provides significant improvement in the thermal characteristics of the VHF power transistors without loss of RF performance. No significant deterioration of performance was noted in the extended duration high temperature testing. These goals were achieved without significant change in the transistor case size or weight. The cooling techniques demonstrated on this program are recommended for production development. Author (GRA)

N74-14948# Denver Univ., Colo. Dept. of Electrical Engineering.
ON THE FEASIBILITY OF SLOW-WAVE-STRUCTURE CLOCKING OF HIGH-FREQUENCY CHARGE-COUPLED DEVICES
R. Bharat Fort Monmouth, N. J. ECOM Oct. 1973 20 p refs Prepared in cooperation with Battelle Columbus. Labs.
(Contract DAHC04-72-A-0001; DA Proj. 1S7-62705-A-440)
(AD-768786; ECOM-4161) Avail: NTIS CSCL 09/1

Coupling an electromagnetic wave through a slow-wave structure is proposed as a method of clocking a charge-coupled device (CCD), in order to obtain high charge-transfer efficiencies at high frequencies. The conditions necessary for synchronizing the velocity of the wave with the drift velocity of charge carriers in the CCD channel are derived. Meander-line clocking for operation of silicon CCDs in this traveling-wave mode appears to be feasible with present technology for clock frequencies in the range of 1 to 250 GHz. At synchronism, diffusion-limited inefficiency in charge transfer is eliminated, allowing operation at high frequencies where surface-state-limited inefficiency is negligible so that transfer efficiencies approaching 100% should be achievable. Author (GRA)

N74-14949# Stanford Univ., Calif. Microwave Lab.
THE TRAVELING SPACE CHARGE WAVE GaAs AMPLIFIER Final Report, 6 Apr. 1972 - 5 Apr. 1973
G. S. Kino, P. Antognetti, G. R. Bisio, and S. Kofol Aug. 1973 54 p
(Contract F30602-72-C-0269; AF Proj. 5573)
(AD-768980; RADC-TR-73-228) Avail: NTIS CSCL 09/1

At the start of the program a batch of amplifiers was made of Stanford material. These amplifiers oscillated because the semiconductor layer was too thick. A new design with Schottky-barrier input and output gates was made, however, no useful experimental results were obtained because of the difficulties in obtaining the necessary high quality material. A new theoretical analysis to predict the input and output impedances of the device was carried out. The conclusion is that it is possible to make a low noise amplifier by operating the input region in the positive differential mobility range. By using a Schottky-barrier at the input, it is possible to control the dc field distribution along the device, and to work with an input impedance in the order of 50 ohms. The output efficiency will be poor unless the devices are made very short with a large gain per unit length, and a short output gap less than half a wavelength long at the saturation velocity of the carriers. Author (GRA)

N74-14950# International Business Machines Corp., Hopewell Junction, N.Y. Fishkill Lab.
RESIDUAL SAW DAMAGE IN SILICON WAFERS AND ITS INFLUENCE ON MOS CAPACITANCE RELAXATION Technical Report, 6 Jun. - 30 Dec. 1972
Guenter H. Schwuttke 1 Jul. 1973 42 p refs
(Contract DAHC15-72-C-0274; ARPA Order 2196)
(AD-768959; SR-2; TR-2) Avail: NTIS CSCL 09/1

Residual saw damage in silicon surfaces and its influence on MOS capacitance relaxation is discussed. Experiments are conducted to gain information on the influence of silicon process parameters on MOS capacitance relaxation. Process parameters investigated include: crystal slicing, wafer cleaning and wafer polishing. The main results of this investigation include evidence about saw damage in the silicon surface and its variation with different slicing and polishing procedures. It is also found that the amount of saw damage is larger in wafers cut from the tail-end relative to wafers cut from the seed-part of the crystal. Based on the results obtained, recommendations are made about future activities of the contract work. Author (GRA)

N74-14951# Ohio State Univ., Columbus. Electro Science Lab.
THEORETICAL AND EXPERIMENTAL INVESTIGATIONS RELATED TO SATELLITE ANTENNA PROBLEMS Final Technical Report, 1 Jul. 1972 - 30 Jun. 1973
G. A. Thiele, E. H. Newman, and T. H. Newhouse Aug. 1973 54 p refs
(Contract N00014-67-A-0232-0018)
(AD-769002; ESL-3468-2) Avail: NTIS CSCL 09/5

The report summarizes applied research undertaken between 1 July 1972 and 30 June 1973 to investigate several problems related to satellite antennas. Briefly, the investigations undertaken can be classified under three topical headings. The first deals with methods for calculating the radiation patterns and impedance of various antennas mounted on various geometries. The second topical heading deals with theoretical methods for analyzing and designing cavity-backed slot antennas such as the T-bar fed slot. The third heading deals with an experimental parametric study of the one port T-bar fed slot antenna. The report concludes with recommendations for future investigations leading to improved satellite antenna techniques. Author (GRA)

N74-14952# Naval Ordnance Lab., White Oak, Md.
SUSCEPTIBILITY OF SEMICONDUCTOR DEVICES TO THERMAL SECOND BREAKDOWN
Norman S. Cohn 21 Mar. 1973 27 p refs
(AD-768751; NOLTR-73-90) Avail: NTIS CSCL 09/1

A method for determining the susceptibility of semiconductor devices to damage from an electromagnetic pulse (EMP) due to induced thermal second breakdown is described. The method can be used as a nondestructive screening test. It is based on the increase in junction reverse breakdown voltage with temperature and can be used to find the most EMP resistant devices of a given type. A mathematical explanation is presented, and other tentative applications are proposed.
Author (GRA)

N74-14953# Harry Diamond Labs., Washington, D.C.
DESIGN AND DEVELOPMENT OF DIELECTRIC ROD ANTENNAS
Howard S. Jones, Jr. Jul. 1973 37 p refs
(AD-768728; HDL-TR-1640) Avail: NTIS CSCL 09/5

A comprehensive study was made on dielectric rod radiators to develop them for use in microwave antenna systems. Several models were designed and constructed using various dielectric materials and advanced design techniques. Theory, design data, and impedance characteristics of these radiators, along with the properties of the dielectric rod materials are given. Performance characteristics for both single and multiple dielectric rod antenna designs are presented demonstrating a variety of feeding techniques. These end-fired radiators have high gain, low side lobes, high decoupling between individual elements, and, in some cases, broad bandwidth characteristics. They are efficient with good directivity and can be compactly designed with small aperatures. Because of these outstanding features, which can be seen from the results presented, dielectric rod radiators offer a decided advantage over electromagnetic horns and other types of microwave antennas. Author (GRA)

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

N74-14954 British Library Lending Div., Boston Spa (England).
AUTOMATIC TESTING SYSTEM FOR A CLASS OF INTEGRATED CIRCUITS DESIGNED BY ADAPTATION OF AN EXISTING AUTOMATIC TRANSISTOR AND DIODE TESTING SYSTEM
Radivoje Popovic and Momcilo Jevtic 8 Nov. 1973 8 p refs Transl. into ENGLISH from Automatika (Zagreb), v. 13, no. 5-6, 1972 p 330-332
(BLL-RDL-Trans-3032-(9022.81)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

An adapter is reported for automatic measuring systems of unmounted semiconductor components. It consists of simple integrated circuits of one type of element -- transistors or diodes -- in sequential series which are followed by the transfer of the contact points to the terminals of the next similarly integrated circuit on the panel. The finding of a faulty circuit is accompanied by the activation of a marking system which is controlled by the test result impulse from the measuring system. G.G.

N74-14955 British Library Lending Div., Boston Spa (England).
ADAPTIVE TIME-OPTIMAL CONTROL BY NONLINEAR SWITCHING FUNCTIONS
T. Iwamoto, Takao Kurokawa, Hiroshi Tamura, Osaku Daigaku, and Kiso Kogaku-bu Aug. 1973 4 p Transl. into ENGLISH from Proc. of 13th Congr. of Automatic Control, no. 127, 16-18 Oct. 1970 p 51-52
(BLL-RTS-7912) Avail: British Library Lending Div., Boston Spa, Engl: £0.40; 1 BLL photocopy coupon

The application of adaptive time-optimal control to an unknown plant by successive correction of the switching function the basis of the state transition pattern of a plant in state space is discussed. Topics discussed include: adaptive form of nonlinear switching function, application of nonlinear switching function, and adaption to change in plant dynamic characteristics. F.O.S.

N74-14956* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
PHASE PROTECTION SYSTEM FOR ac POWER LINES Patent
Wing J. Wong, inventor (to NASA) (N. Am. Rockwell Corp., Downey, Calif.) Issued 1 Jan. 1974 5 p Filed 29 Sep. 1972 Supersedes N72-33232 (10 - 24, p 3195) Sponsored by NASA
(NASA-Case-MSC-17832-1; US-Patent-3,783,354;
US-Patent-Appl-SN-293727; US-Patent-Class-317-33SC;
US-Patent-Class-317-43; US-Patent-Class-317-47;
US-Patent-Class-317-48; US-Patent-Class-307-127;
US-Patent-Class-317-46) Avail: US Patent Office CSCL 09C

The system described provides protection for phase sensitive loads from being or remaining connected to ac power lines whenever a phase reversal occurs. It comprises a solid state phase detection circuit, a dc power relay circuit, an ac-to-dc converter for energizing the relay circuit, and a bistable four terminal transducer coupled between the phase detection circuit and the power relay circuit, for controlling both circuits.
Official Gazette of the U.S. Patent Office

N74-14957*# Kanner (Leo) Associates, Redwood City, Calif.
ELECTRONICS IN SOVIET HEALTH RESORTS
N. Konakh Washington NASA Jan. 1974 4 p Transl. into ENGLISH from Med. Gazeta (Moscow), 7 Dec. 1973 p 4
(Contract NASw-2481)
(NASA-TT-F-15284) Avail: NTIS HC $3.00 CSCL 09C

The rise in use of computer technology and biotelemetric apparatus is reported in various health resorts, especially in Kislovodsk, where a biotelemetry laboratory was created several years ago. An example is given of the biotelemetric system in use in which a doctor records the electrocardiogram of a patient who may be 4-5 km away and at the same time advises him on his walking pace. The pace is set by an electronic pacer also developed in this laboratory. Biosensors are used by the doctor to monitor the patient's condition during almost any activity. Computer technology is also used to analyze diagnostic data and store patient's medical histories. Author

N74-14958# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ADVANCED ELECTRONIC TECHNOLOGY Quarterly Technical Summary, 1 May - 31 Jul. 1973
Melvin A. Herlin, Herbert G. Weiss, and Alan L. McWhorter 15 Aug. 1973 24 p refs
(Contract F19628-73-C-0002; AF Proj. 649L)
(AD-768394; ESD-TR-73-237) Avail: NTIS CSCL 09/5

The Quarterly Technical Summary covers the period 1 May 1973 through 31 July 1973. It consolidates the reports of Division 2 (Data Systems), Division 4 (Air Traffic Control), and Division 8 (Solid State) on the Advanced Electronic Technology Program. Author (GRA)

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N74-14959*# Pennsylvania State Univ., University Park. Systems and Controls Lab.
[FLUIDICS RESEARCH, INCLUDING VORTEX AND JET PIPE VALVES]
Jul. 1973 14 p refs
(Grant NGR-39-009-023; Contract DAAG39-72-C-0190)
(NASA-CR-13653; PSU-SCL-16(73A); RR-16) Avail: NTIS HC $3.00 CSCL 14B

The research at the Systems and Control Laboratory is reported. Topics discussed include: response characteristics of laminar fluidic amplifiers, power amplification with a vortex valve, pulse-supply-mode fluidics, speed control system employing a jet pipe valve, and the fluidics reference center. F.O.S.

N74-14960# National Aeronautical Lab., Bangalore (India).
WIND TUNNEL DYNAMIC MODELS FOR AERO ELASTIC STUDIES IN TRANSONIC FLOW
Roger Destuynder and Roger Labourdettee 1972 25 p Transl. into ENGLISH from Rech. Aerosp. (Paris), no. 2, Mar. - Apr. 1972 p 107-112
(NAL-TR-148) Avail: NTIS HC $3.25

Parameters of similarity are defined, and the rules which were followed for the definition of the models are also established. The principles of construction and inspection of models, are described, as well as of their suspensions. The dynamic stability of the aircraft is simulated, as well as the characteristic breakdown and structural damage of the plane. Author

N74-14961# National Aeronautical Lab., Bangalore (India). Propulsion Div.
A NOTE ON THE KINETIC HEATING TEST FACILITIES AT THE INSTITUTE OF AIRCRAFT STRUCTURES IN PORZ-WAHN
Hans Katsal Sep. 1973 10 p refs Transl. into ENGLISH of the publ. "Anlage zur Kinetischen Aufheizung des Instituts fuer Flugzeugbau, ABT. Thermoelastik in Porz-Wahn" Porz-Wahn, West Germany, Jun. 1973
(NAL-TR-184) Avail: NTIS HC $3.00

The kinetic heating test facility is an infrared simulation facility to produce and control steady and unsteady state temperatures and heat flow fields over any geometrically shaped structural components. The range of application includes: (1) investigation on heat conduction and radiation phenomena in solid bodies; (2) strength investigations of thermally and statically loaded structural components; (3) investigations of dynamic phenomenon or studies like thermally excited vibration, shock stresses, thermal stress reversals; (4) investigation of stability and failure of structures under thermal and static loading. In all cases the facility can be used for quantitative assessment of stresses computed analytically or testing structures which are generally difficult to solve analytically or for the verification of theoretical results. Author

N74-14962*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GAS FLOW ANALYSIS DURING THERMAL VACUUM TEST OF A SPACECRAFT
John J. Scialdone Washington Jan. 1974 22 p refs
(NASA-TN-D-7492; G-7346) Avail: NTIS HC $2.75 CSCL 20D

The self-contamination of the IMP-H spacecraft, while it was undergoing thermal and solar vacuum tests, has been investigated in conjunction with the outgassing evaluation and detection of

molecular flow anomalies occurring in the test chamber. The pressures indicated by two tubulated ionization gauges were used to calculate flow kinetics in the vacuum chamber. The fluxes of emitted molecules and chamber wall reflected molecules were monitored during the entire test. Representative equations and graphs are presented. Test results indicate that from 3 to 9 of every 100 emitted molecules returned to the spacecraft surface; that self-contamination by noncondensable gases was more severe than that by condensable gases; and that outgassing of the spacecraft was approximately 1.18 x 0.01 g/s after 10 hours and 1.18 x 0.001 after 90 hours of vacuum exposure. Testing deficiencies have been identified, and the type and location of instruments required to measure the outgassing, the degree of contamination, and return flow are discussed. Author

N74-14963*# Kanner (Leo) Associates, Redwood City, Calif.
QUESTIONNAIRE SURVEY OF APPROACH LIGHT
N. Iwataki Washington NASA Jan. 1974 9 p refs Transl. into ENGLISH from Japan Air Self-Def. Force, Aeromed. Lab. Reports, v. 8, Mar. 1968 p 195-198
(Contract NASw-2481)
(NASA-TT-F-15277) Avail: NTIS HC $3.00 CSCL 01E

The results of a survey are presented which includes a questionnaire polling of 27 pilots on the efficiency of various methods of approach lighting. The Calvert bar system and strobe flash lighting were both considered useful visual aids in approach lighting at low visibility, with strobe flash lighting giving less glare. The pilots agreed, however, that on clear nights approach lighting could cause a disturbing glare in the final landing stage. Author

N74-14964# Army Construction Engineering Research Lab., Champaign, Ill.
TECHNOLOGY FORECASTING: A CASE STUDY OF LONG-TERM REQUIREMENTS FOR RIGID AIRFIELD PAVEMENT SYSTEMS
William J. Pananos Aug. 1973 55 p refs
(DA Proj. 4A0-62112-A-891)
(AD-767530; CERL-TR-A-19) Avail: NTIS CSCL 01/5

The report presents the in-action example of the Delphi method of technological forcasting, which involves polling expert opinion. Experts in the planning, design, construction, and operation of airfields were polled to develop a forecast of technical capabilities in those areas. The results demonstrate how the wide range of information obtainable from expert opinion can be conveniently presented to planners. An analysis of the convergence of opinion after two rounds of questioning indicates that more than one round may be unnecessary to obtain the subjective type of information discussed in the forecast. Author (GRA)

N74-14815* National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.
WALLOPS AND ITS ROLE IN DEPRESSED METABOLISM
Emily M. Holton *In its* Regulatory Biol.: Depressed Metab. Aug. 1973 p 23-26 (For availability see N74-14813 06-04) CSCL 14B

N74-15556 European Space Research and Technology Center, Noordwijk (Netherlands). Engineering and Testing Div.
MEASUREMENT OF THE INFRARED BACKGROUND IN THE ESTEC SPACE CHAMBERS HBF 2 AND HBF 3
G. Saenger *In* ESRO Struct. and Thermal Tests, vol. 3 Jun. 1973 p 125-135 refs (For availability see N74-15548 06-31)

N74-15557 Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (West Germany).
CALIBRATION AND CHARACTERISTIC MEASUREMENTS OF A SOLAR SIMULATOR FACILITY FOR THERMAL BALANCE TESTS
H. Nuss *In* ESRO Struct. and Thermal Tests, Vol. 3 Jun. 1973 p 137-155 (For availability see N74-15548 06-31)

N74-15558 Centre National d'Etudes Spatiales, Toulouse (France).
EVALUATION OF CHARACTERISTICS OF A SOLAR SIMULATOR REQUIRED FOR THERMAL VACUUM TESTS [EVALUATION DES CARACTERISTIQUES D'UN SIMULATEUR SOLAIRE NECESSAIRES A LA CONDUITE D'UN ESSAI VIDE-SOLEIL]
D. Dabadie *In* ESRO Struct. and Thermal Tests, Vol. 3 Jun. 1973 p 157-174 In FRENCH (For availability see N74-15548 06-31)

N74-15559 European Space Research and Technology Center, Noordwijk (Netherlands). Engineering and Testing Div.
METHODS TO DETERMINE INTENSITY LEVELS AT POINTS OF AREAS WITHIN THE TEST VOLUME OF THE DIVERGENT SOLAR SIMULATOR OF THE HEAT BALANCE FACILITY HBF 3 AT ESTEC
P. W. Brinkmann *In* ESRO Struct. and Thermal Tests, Vol. 3 Jun. 1973 p 175-200 refs (For availability see N74-15548 06-31)

N74-15560 Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (West Germany).
RESULTS OF THE APPLICATION OF A 30 kW HIGH PRESSURE XENON LAMP IN THE IABG SOLAR SIMULATOR FOR THERMAL BALANCE TESTING
H. J. Geil, H. Nuss, and R. Pfeifer *In* ESRO Struct. and Thermal Tests, Vol. 3 Jun. 1973 p 201-216 (For availability see N74-15548 06-31)

N74-15561 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany).
CONTROL OF RADIOMETER CALIBRATION CURVES BY COMPARISON MEASUREMENTS IN PERIODICALLY FIXED INTERVALS
W. Ley *In* ESRO Struct. and Thermal Tests, Vol. 3 Jun. 1973 p 217-229 (For availability see N74-15548 06-31)

N74-15562 Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (West Germany).
THERMAL BALANCE TESTING WITH SOLAR SIMULATION AND VARIABLE INFRARED HEATING FOR FIRST-ORDER APPROXIMATION OF EARTH AND ALBEDO RADIATION WITH THE FLIGHT UNIT OF AEROS
J. Reimann and H. Staatsmann (Dornier System, Friedrichshafen, West Ger.) *In* ESRO Struct. and Thermal Tests, Vol. 3 Jun. 1973 p 231-261 (For availability see N74-15548 06-31)

N74-15565 Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (West Germany).
FACILITY FOR HIGH INTENSITY THERMAL BALANCE TESTING USING THE INFRARED CANISTER METHOD
J. Reimann *In* ESRO Struct. and Thermal Tests, Vol. 3 Jun. 1973 p 335-349 (For availability see N74-15548 06-31)

N74-15566 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany).
THE SIMULATION OF HIGH IRRADIANCES IN THE SPACE SIMULATION INSTITUTE OF THE DFVLR: POSSIBILITIES AND EXPERIENCES
R. Naehle *In* ESRO Struct. and Thermal Tests, Vol. 3 Jun. 1973 p 351-363 (For availability see N74-15548 06-31)

N74-15570 Bosch (Robert) G.m.b.H., Stuttgart (West Germany).
EXPERIENCE IN THE USE OF WATER-COOLED HIGH-POWER LAMPS FOR SOLAR SIMULATION
J. Artmann, H. Haug, and F. Prinzhausen *In* ESRO Struct. and Thermal Tests, Vol. 3 Jun. 1973 p 431-441 (For availability see N74-15548 06-31)

N74-15571 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany).
MEASUREMENT OF THERMAL ERRORS DURING SPACE SIMULATION IN THE IABG FACILITY
H. J. Geil (Industrieanlagen-Betriebsges.), H. Nuss (Industrieanlagen-Betriebsges.), Pieper (Dornier System), W. Hallmann, K. Kramp, and H. P. Schmidt *In* ESRO Struct. and Thermal Tests, Vol. 3 Jun. 1973 p 443-457 (For availability see N74-15548 06-31)

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N74-14965 British Library Lending Div., Boston Spa (England).
AIR EFFECTS IN AIRCRAFT HYDRAULIC SYSTEMS MEASURES FOR THEIR REMOVAL
E. Koch 10 Oct. 1973 11 p refs Transl. into ENGLISH from Oelhydraulik und Pneumatik, v. 15, no. 11, 1971 p 465-469 In ENGLISH and GERMAN
(BLL-NEL-TT-2420-(6075.461)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

The effects of bubbles in hydraulic systems are discussed. It is stated that the presence of air causes the compressibility of the system and the amount of work done in volume change to increase. The elasticity of the oil column is considered the primary cause for deficient performance under dynamic loading and for inadequate static performance. An increase in temperature within the system is also encountered during dynamic operations because of the adiabatic compression of the air. Trapped air also causes a chemical reaction which results in oxidation of the hydraulic fluid. Author

N74-14966 Iowa State Univ. of Science and Technology, Ames.
DROP SHAPES AND INTERNAL FLOW PATTERNS BY NUMERICAL SOLUTION OF THE NAVIER-STOKES EQUATIONS Ph.D. Thesis
Thomas Denniston Sandry 1973 164 p
(Contract W-7405-eng-82)
(IS-T-579) Avail: Univ. Microfilms Order No. 73-25253

The shape of and flow patterns within a hypothetical separating drop were determined by numerical solution of the Navier-Stokes equations. The drop was hypothetical in the sense that it separated because the surface tension force restraining it was reduced at the start of calculation. However, the velocity distributions and shape of the drop resemble those of an actual drop as it separates. Considerable surface stretch was observed at the sides of the drop and very little at the apex. The flow pattern within the drop was found to approach plug flow in the direction of gravity when the drop began to stretch out. These results were also observed when a surface tension force was applied at the interface. The flow patterns within a constant volume forced internal circulation drop were also determined numerically for various flow rates and viscosities. Dissert. Abstr.

N74-14967 City Univ. of New York.
DRAG REDUCTION IN DILUTE FLOWING GAS-SOLIDS SUSPENSIONS Ph.D. Thesis
Ronald Steven Kane 1973 266 p
Avail: Univ. Microfilms Order No. 73-22736

Flow and heat transfer measurements were performed on dilute gas-solids suspensions flowing in a closed loop system. The flow measurements included data, in the presence of particles, on gas friction factors, gas velocity profiles, gas turbulence intensity profiles, gas turbulent spectra, and particle velocity profiles. During flow measurements, glass beads ranging in size from 10 to 60 microns diameter were suspended in air at gas Reynolds numbers of 10,000 to 25,000 and solids loading ratios from 0 to 4. Pressure drop and heat transfer measurements were taken in both horizontal and vertical 0.870 inch inside diameter tubes. Profile measurements were taken only in the vertical tube. The heat transfer work included data on argon-glass and argon-aluminum suspensions. Dissert. Abstr.

N74-14968 Maryland Univ., College Park.
AN EXPERIMENTAL INVESTIGATION OF THE EFFECT OF UPSTREAM CONDITIONS ON THE DOWNSTREAM CHARACTERISTICS OF COMPRESSIBLE TURBULENT BOUNDARY LAYERS Ph.D. Thesis
David Franklin Gates 1973 128 p
Avail: Univ. Microfilms Order No. 73-23731

An experimental study is described of steady turbulent compressible boundary layers for which the upstream history was systematically varied. Variation was achieved through a series of experiments using both a supersonic half nozzle and a conventional flat plate with temperature controlled nozzle throat or leading edge conditions. All profile and heat transfer measurements were made in a downstream region of zero-pressure gradient and constant or nearly constant wall temperature. In this downstream region free stream Mach numbers were 4 and 5 and the momentum thickness Reynolds number varied from 9,000 to 29,000 The degree of energy removal or addition is indicated by the ratio of total enthalpy thickness to the boundary layer thickness. This ratio varied from -.02 for energy addition to .03 for energy removal. Measurements were also made in the $dp/dx = 0$ region for successive downstream distances to observe the nature and extent of profile relaxation. Dissert. Abstr.

N74-14969 Missouri Univ., Columbia.
LOCAL FREE CONVECTION TO NON-NEWTONIAN FLUIDS FROM A HORIZONTAL, ISOTHERMAL CYLINDER Ph.D. Thesis
Cecil Calvin Gentry, Jr. 1972 306 p
Avail: Univ. Microfilms Order No. 73-21419

The determination of local free convection heat transfer rates from a horizontal isothermal cylinder to nonNewtonian fluids under laminar flow conditions is discussed. An approximate integral solution was obtained for the integrated boundary layer equations under the condition that the inertial terms appearing in the momentum equation become negligible as the Prandtl number group approaches infinity. The analysis was limited to the steady, two-dimensional case. Physical properties were assumed to be constant, except for the density difference existing between the boundary layer region and the quiescent bulk fluid. Frictional dissipation and circumferential conduction were both negelected in the energy equation. Hydrodynamic and thermal boundary layer thickness were assumed to be equal. Integral solution results, in local Nusselt number form, were in agreement with measured experimental data. Dissert. Abstr.

N74-14970 Michigan Univ., Ann Arbor.
ENERGY CONSERVATION AND THE TRUNCATED SPECTRAL FORM OF THE PRIMITIVE EQUATIONS FOR A ONE-LAYER FLUID Ph.D. Thesis
William Franklin Weigle 1972 244 p
Avail: Univ. Microfilms Order No. 73-24713

Two spectral forms of an energetically closed set of partial differential equations commonly used in meteorology and oceanography are investigated to see if they conserve total energy when truncated. The equations are the one-layer primitive equations for a fluid with a free upper surface. They are expressed in terms of prognostic equations for the vorticity or stream function, the divergence or velocity potential, and the height of the free surface. An expansion of the variables into double Fourier series on a piane with cyclic boundary conditions and an expansion into spherical harmonics on a sphere were considered. With both expansions, the general result is that the total energy of the truncated spectral form of the primitive equations cannot be conserved; however, several approximate forms of the equations will conserve energy if the variables are truncated correctly. Dissert. Abstr.

N74-14971 Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
ON THE BEHAVIOUR OF VISCOUS LAYERS IN VISCOUS INTERACTION PROBLEMS
M. Georgeff Aug. 1973 15 p refs
(IC-Aero-71-17) HC $3.00

The distinction between stable (supercritical) and unstable (subcritical) viscous layers is clarified, and the implications of this concept discussed. Throats and critical points are clearly defined, and the solution behavior of the governing equations in the vicinity of these points is described. Author (ESRO)

N74-14972 Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
DIGITAL ANALYSIS OF TURBULENT FLOWS
A. Brandt Dec. 1971 28 p refs
(Grant SR-B/SR/7377)

(IC-Aero-71-27)

The statistical analysis of random signals by digital techniques is discussed, with particular regard to the analysis of turbulent flow data. The formulation of accuracy estimates for statistical calculations is discussed, and a simple accuracy estimate, which can be related to a physically meaningful allowable error is presented. The crucial question in statistical data analysis is that of convergence. A procedure is proposed which insures convergence to a desired, physically significant level of accuracy, using a minimal amount of data. Author (ESRO)

N74-14973# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.

TRANSVERSE VELOCITY AND PRESSURE VARIATIONS IN FINITE JOURNAL BEARINGS AND CYLINDERS

O. Pinkus Jul. 1972 88 p refs

(TAE-157) Avail: NTIS HC $6.50

Based on an extension of the Reynolds Equation, solutions are given for transverse velocity and pressure variations in an incompressible fluid contained between rotating eccentric cylinders. Results are given for the entire range of finite outer cylinders, from L/D = O to L/D = infinity. The solutions are based on the retention of the principal viscous stresses plus the effect of the centrifugal force of the rotating fluid which proves to be the dominant term. Iteration procedures are outlined for cases of high Taylor Numbers. Author

N74-14974# National Aeronautical Lab., Bangalore (India).

APPLICATION OF DIFFERENTIAL EQUATION FOR TURBULENT VISCOSITY TO THE ANALYSIS OF PLANE NON-SELF-SIMILAR FLOWS

A. N. Sekundov Aug. 1972 46 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (Moscow), no. 5, Sep. - Oct. 1971 p 114-127

(NAL-TR-144) Avail: NTIS HC $4.50

Based on equations for the average motion in turbulent flows, a differential equation for turbulent viscosity is derived. Numerical calculations of the incompressible turbulent and transitional flows in wakes, jet and boundary layers, and improved universal constants occurring in equations for viscosity are presented. The flow in the wade and boundary layer with a larger longitudinal pressure gradients was investigated by analytical and numerical methods. A nondimensional criterion for determining the character of the influence of the pressure gradient on the average flow and turbulent viscosity were obtained. Author

N74-14975# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).

THE EQUATION OF STATE OF A SYSTEM OF HARD SPHEROCYLINDERS

Jacques Vieillard-Baron Oct. 1973 20 p refs

(Ipthe-73/28) Avail: NTIS HC $3.00

Using the Monte Carlo method, the equation of state of a system of hard spherocylinders (cylinders with a hemisphere at each end) of length-to-breadth ratio equal to 3, in the isotropic liquid phase was computed. A pressure was obtained slightly smaller than that predicted by the scaled-particle theory (SPT). The SPT predicts a liquid to nematic transition when the density is increased; the isotropic liquid phase was observed to be stable up to densities significantly higher than the SPT transition density. Using the free-volume theory, the behavior of the pressure at very high densities was determined for any value of the length-to-breadth ratio gamma. The packing fraction (number density times the volume of one spherocylinder) is shown to correspond to the beginning of solid fusion as an increasing function of gamma. Author

N74-14976*# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.

UNSTEADY VISCOUS EFFECTS IN THE FLOW OVER AN OSCILLATING SURFACE

James I. Lerner Dec. 1972 207 p refs

(Grant NGR-05-020-102; Contract F44620-68-C-0036)

(NASA-CR-136581; SUDAAR-453) Avail: NTIS HC $12.50 CSCL 20D

A theoretical model for the interaction of a turbulent boundary layer with an oscillating wavy surface over which a fluid is flowing is developed, with an application to wind-driven water waves and to panel flutter in low supersonic flow. A systematic methodology is developed to obtain the surface pressure distribution by considering separately the effects on the perturbed flow of a mean shear velocity profile, viscous stresses, the turbulent Reynolds stresses, compressibility, and three-dimensionality. The inviscid theory is applied to the wind-water wave problem by specializing to traveling-wave disturbances, and the pressure magnitude and phase shift as a function of the wave phase speed are computed for a logarithmic mean velocity profile and compared with inviscid theory and experiment. The results agree with experimental evidence for the stabilization of the panel motion due to the influence of the unsteady boundary layer. Author

N74-14977# Lockheed Missiles and Space Co., Palo Alto, Calif.

KELVIN WAVE DIFFRACTION BY A SEMI-INFINITE WALL IN AN INFINITE BASIN

S. A. Gabov [1973] 8 p refs Transl. into ENGLISH from Vestn. Mosk. Univ., Ser. 1: Mat. i Mekhan (Moscow), no. 5, 1973 p 100-107

Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Illinois 60616

Kelvin wave diffraction by the edge of a semi-infinite wall is investigated. The wall is located in an infinite basin that rotates counter clockwise. A Wiener-Hopf method was used for the study. Author

N74-14978*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

DECAY OF FAR FLOW FIELD IN TRAILING VORTICES

B. S. Baldwin, N. A. Chigier, and Y. S. Sheaffer Washington Feb. 1974 18 p refs

(NASA-TN-D-7568; A-5181) Avail: NTIS HC $2.75 CSCL 20D

A finite difference machine code is used in the wake vortex problems in the quasi-cylindrical boundary layer approximation. A turbulent energy model containing new features is developed that accounts for the major effects disclosed by more advanced models in which the parameters are not yet established. Several puzzles that arose in previous theoretical investigations of wake vortices are resolved. Author

N74-14979# Oxford Univ. (England). Engineering Lab.

DNF: A DYNAMIC FILTER FOR THE ON-LINE ESTIMATION AND PREDICTION OF TRANSIENT PRESSURES AND FLOWS IN A GAS NETWORK

R. Hastings-James 27 Mar. 1973 72 p refs

(Rept-1064/73) Avail: NTIS HC $5.75

The use of a dynamic gas network model as a basis for filtering noisy measurements taken of actual network pressures is considered. The model allows the estimation of other network pressures of interest but for which no measurements are available. The features of the filter proposed for estimating the pressures and flows in the gas network under transient conditions are outlined. The encouraging preliminary experimental results, together with the filter features and the fact that the filtering algorithm can be set up with minimal operator interaction, have strong implications towards the utilization of a digital computer to provide on-line estimates and future predictions of netwprk pressures and flows. ESRO

N74-14980# Mississippi State Univ., State College.

NUMERICAL SOLUTION OF THE THREE-DIMENSIONAL NAVIER-STOKES EQUATIONS IN INTEGRO-DIFFERENTIAL FORM: FLOW ABOUT A FINITE BODY

J. F. Thompson, Jr., S. P. Shanks, and J. C. Wu (Ga. Inst. of Tech.) 1973 13 p refs Presented at the AIAA Computational Fluid Dyn. Conf., Palm Springs, Calif., 19-20 Jul. 1973

(Contract DAHC04-68-C-003)

(AD-768917; AROD-T-3-17-E) Avail: NTIS CSCL 20/4

A new method of numerical solution of the incompressible Navier-Stokes equations is applied to time-dependent flow about a rectangular slab at an angle of attack. With this formulation the solution is obtained in the entire unbounded flow field, but with actual computation required only in regions of significant vorticity. This allows considerable reduction in computer storage, since only points in regions of signficant vorticity need be stored

at any particular time. The computational field thus expands in time. (Modified author abstract) GRA

N74-14981# Polytechnic Inst. of Brooklyn, Farmingdale, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
EXPERIMENTS IN MULTI-DIMENSIONAL FLOATING SHOCK-FITTING
Gino Moretti Aug. 1973 52 p refs
(Contract N00014-67-A-0438-0009)
(AD-768841; PIBAL-73-18) Avail: NTIS CSCL 20/4

Four numerical experiments are performed to support floating shock-fitting techniques in multi-dimensional flow problems. By floating shock-fitting is meant the fitting of a shock as a sharp discontinuity, free of moving within the computational mesh. Evidences of accuracy and stability are given. Author (GRA)

N74-14982# Lehigh Univ., Bethlehem, Pa. Center for the Application of Mathematics.
CONDENSATION SHOCKS
C. J. Shih and P. A. Blythe Aug. 1973 53 p refs
(Contract DAAD05-69-C-0053; Proj. Themis)
(AD-768902; CAM-100-29; BRL-CR-115) Avail: NTIS CSCL 20/4

Supersonic nozzle flows of a condensible vapor are considered in the high activation limit for homogeneous nucleation. Conditions under which the final collapse of the supersaturated state is described by a condensation shock are determined. The analysis leads to a natural definition for the shock position. It is shown that the shock zone is associated with droplet growth. Droplet production occurs upstream of this region. Some useful similarity laws are obtained for the production zone. Author (GRA)

N74-14983# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MIXED FLOW EQUATIONS
Yu. G. Logachev 1 Oct. 1973 34 p refs Transl. into ENGLISH from Mekh. Protsessov Aviats. Opryskivaniya i Rasseivaniya Sypuchikh Veshchestv (USSR), v. 3, no. 219, 1971 p 17-43
(AD-768419; FTD-HT-23-855-73) Avail: NTIS CSCL 20/4

The viewpoint of L. Euler is assumed for the motion of a mixed medium in a stationary space. Under these circumstances parameters in the general case are functions of coordinates and time. The mixed medium consists of an air medium and particles of matter. GRA

N74-14984# Nielsen Engineering and Research, Inc., Mountain View, Calif.
THEORETICAL ANALYSIS OF CYCLOIDAL PROPELLERS Final Report, 1 May 1970 - 30 Jun. 1973
Michael R. Mendenhall and S. B. Spangler 30 Jun. 1973 95 p refs
(Contract N00014-70-C-0346)
(AD-768910; NEAR-TR-53) Avail: NTIS CSCL 13/10

A theoretical analysis of a cycloidal propeller was developed which accounts for the detailed structure of the wakes shed from the blades and their influence on blade loading. The analysis was developed for the two-dimensional case (infinite blade aspect ratio) and programmed for a digital computer. Calculations made over a range of pitch and advance ratio values indicate the wake to have a major influence in reducing the blade loading at low advance ratios. High local blade loadings occur when a blade passes near a wake vortex, and blade stall must be accounted for in the method. Comparisons with model propeller data indicate that the theory predicts the proper trends and levels of thrust, side force, and torque over a wide range of advance ratio and pitch. Author (GRA)

N74-14985# Army Missile Command, Redstone Arsenal, Ala.
STATIC TEST PERFORMANCE CHARACTERISTICS OF SEVERAL FLUIDIC CONTROL VALVE CONFIGURATIONS
Troy A. Street, Thomas L. Killough, and Robert E. Becht 14 Sep. 1973 68 p refs
(DA Proj. 1M2-62303-A-214)
(AD-768772; RD-TR-73-29) Avail: NTIS CSCL 13/7

A static test has been conducted for seven fluidic valve configurations. The plenum pressure was varied from 500 to 1500 psia, which represented design (1200 psia) and off-design pressures. The measurements were forces, moments, internal static pressures, and valve exit total pressures. The data are graphically presented and discussed. Author (GRA)

N74-14986# Lehigh Univ., Bethlehem, Pa. Dept. of Mechanical Engineering and Mechanics.
WALL JET RECEIVER FLOW FIELD
Hsiang-sheng Shen and Donald O. Rockwell Aug. 1973 219 p refs
(Contract N00014-69-A-0417)
(AD-768882; THEMIS-LU-TR-18) Avail: NTIS CSCL 20/4

The wall jet-receiver flow field was studied analytically and experimentally for two values of jet nozzle exit Reynolds number (5000 and 14,000). Various distances of receiver entrance from jet nozzle exit, receiver throughflow conditions, and dimensionless receiver widths were considered. Four different flow regimes were identified, and corresponding regime maps were constructed. Potential flow, frozen vorticity, and control volume techniques were used to predict the receiver influence length, receiver pressure recovery, receiver entrance spill flow angle, and velocity profiles inside the receiver. Author (GRA)

N74-14987# Lehigh Univ., Bethlehem, Pa. Dept. of Mechnical Engineering and Mechanics.
LAMINAR FLOW IN A TWO-DIMENSIONAL CHANNEL WITH A RIGHT ANGLE CORNER
R. M. Wilson and J. A. Owczarek Aug. 1973 153 p refs
(Contract N00014-69-A-0417; Proj. Themis)
(AD-768881; THEMIS-LU-TR-19) Avail: NTIS CSCL 20/4

Laminar, steady, incompressible flow in a two-dimensional channel with a right angle corner was investigated by numerical analysis and experimental measurement. The problem was used as a vehicle to compare a finite differencing method with an upwind differencing scheme. From the numerical solutions, zones of separated flow in the outside (reentrant) corner were found at all Reynolds numbers investigated. A second separation region, extending downstream from the inside (salient) corner was found. Several different methods of formulating the vorticity at the salient corner were investigated. Experimentally measured velocity profiles and smoke photographs of the separation regions indicated reasonable agreement with calculated solutions. (Modified author abstract) GRA

N74-14988# Sydney Univ. (Australia). Dept. of Aeronautical Engineering.
NUMERICAL STUDIES IN GAS DYNAMICS Interim Report, 15 Apr. 1972 - 14 Apr. 1973
Graeme A. Bird 15 Apr. 1973 7 p refs
(Grant AF-AFOSR-2336-72; AF Proj. 9783)
(AD-768612; AFOSR-73-1949TR) Avail: NTIS CSCL 20/4

A study was made of the flow which results when an initially uniform gas expands into a vacuum through a complete one-dimensional rarefaction wave and then strikes a solid wall or similar opposite facing rarefaction. Calculation of the asymptotic temperature at the wall or line of symmetry involves a molecular analysis of the initial stages of reflection. A direct simulation Monte Carlo method was supported by continuum calculations and experiment. A combined numerical analytical and experimental study was also carried out for the thermal forces on very small particles suspended in the atmosphere. (Modified author abstract) GRA

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N74-14989 British Library Lending Div., Boston Spa (England).
THE CALCULATION OF ELECTRIC FIELD INTENSITY IN MOUNTAINOUS REGIONS BY DIGITAL COMPUTER
Y. Nagasawa and R. Sato Feb. 1973 19 p refs Transl. into ENGLISH from Tohoku-daigaku Dentsu Danwakai Kiroku (Japan), v. 40, no. 4, 1971 p 22-27
(BLL-RTS-7781) Avail: British Library Lending Div., Boston

Spa Engl.: £ 1.80; 6 BLL photocopy coupons

The use of Nomura's calculation method in conjunction with a digital computer to study VHF and UHF wave propagation behavior is mountainous regions is discussed. In particular, field intensity in these areas is discussed. Various problems encountered in dealing with computer calculation are included. E.H.W.

N74-14990 Colorado Univ., Boulder.
A CLIMATOLOGICAL STUDY OF STRONG DOWNSLOPE WINDS IN THE BOULDER AREA Ph.D. Thesis
Waltraud Augusta Rosalie Brinkmann 1973 252 p
Avail: Univ. Microfilms Order No. 73-23237

A climatological study was made of the characteristics of 20 Boulder storms with gusts exceeding hurricane force speeds. Boulder storms are generally considered to be part of the system of warm Chinook winds occuring in the lee of the Rocky Mountains, but of the 20 storm cases almost half were found to be genetically cold. The storms were found to occur most frequently in morning hours in the month of January. Their gustiness was found to be much higher than averages determined for the temperature zone but similar to that of other warm and cold downslope winds around the world. It is hypothesized that all downslope wind storms may be generated by a similar mechanism. Conditions favorable for Boulder's wind storms were found to be the existence of a stable layer above mountain top as well as relatively strong winds at the level but speeds not too high in the upper troposphere. It appears that these air mass characteristics lead to the development of a deep lee flow disturbance over the eastern slopes. It was concluded that wind maxima on the slopes and out into the planes do not tend to coincide with storms in Boulder. Dissert. Abstr.

N74-14991 Michigan Univ., Ann Arbor.
WIND DRIVEN AND SEICHE FORCED WATER MOTION IN GRAND TRAVERSE BAY, MICHIGAN Ph.D. Thesis
Edward Bradford Smith 1973 137 p
Avail: Univ. Microfilms Order No. 73-24687

The barotropic equations for two dimensional motion have been approximated by a finite difference scheme and applied to Grand Traverse Bay, Michigan. Detailed computer runs were made for various typical wind and Lake Michigan seiche forcing conditions and this output is presented in graphical form. Agreement with observations is quite good and several curious phenomena were explained. For one particularly complicated case a computer generated movie was made. No evidence of numerical instability was observed with the scheme used. A listing of computer program, which is written in a form applicable to any body of water, is included. There are closed circulation patterns which do not directly correspond to constant depth contours. Dissert. Abstr.

N74-14992 Pennsylvania Univ., Philadelphia.
A THREE-DIMENSIONAL MODEL OF THE THERMOSPHERE WITH AURORAL HEATING Ph.D. Thesis
Raivo Vest 1973 179 p
Avail: Univ. Microfilms Order No. 73-24048

A three-dimensional steady state model of the dynamics of the upper atmosphere is developed by the simultaneous solution of the equations of continuity, conservation of momentum, and conservation of energy over the entire upper atmosphere. Detailed consideration is given to the diffusion processes, the shear stresses, and the energy transport mechanisms, and to the thermal conductivity and viscosity effects in a multicomponent mixture. The resulting system of equations is solved by a digital computer to yield realistic values for the temperatures, densities, and nighttime winds in the upper atmosphere. The daytime winds are overestimated by about a factor of three, since the effects due to collisions with ionized components were neglected. A reasonable profile of the auroral heating input during solar storms is incorported into the model and the effect produced by this heating on the upper atmosphere is evaluated. Dissert. Abstr.

N74-14993*# Ohio Dept. of Economic and Community Development, Columbus.
[REGIONAL AND LOCAL LAND USE PLANNING AND MAPPING IN OHIO FROM SKYLAB EREP DATA] Quarterly Progress Report, Oct. - Dec. 1973
David C. Sweet, Principal Investigator 8 Jan. 1974 1 p
EREP
(NASA Order C-21372-C)
(E74-10176; NASA-CR-136305; QPR-3) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N74-14994*# Wisconsin Univ., Madison. Environmental Monitoring and Data Acquisition Group.
EVALUATION OF THE APPLICATION OF ERTS-1 DATA TO THE REGIONAL LAND USE PLANNING PROCESS Progress Report, 1 Jun. - 1 Dec. 1973
James L. Clapp, Principal Investigator 20 Dec. 1973 129 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21754)
(E74-10178; NASA-CR-136309) Avail: NTIS HC $8.50 CSCL 08B

There are no author-identified significant results in this report.

N74-14995*# Geological Survey, Reston, Va.
SATELLITE GEOLOGICAL AND GEOPHYSICAL REMOTE SENSING OF ICELAND. VATNAJOEKULL AREA, ICELAND: NEW VOLCANIC AND STRUCTURAL FEATURES ON ERTS-1 IMAGERY Special Report No. 3
Richard S. Williams, Jr., Principal Investigator, Sigurour Thorarinsson (Iceland Univ.), and Kristjan Saemundsson (Natl. Energy Authority, Reykjavik, Iceland) 15 Dec. 1973 3 p Repr. from Geol. Soc. of Am. Abstr. with Programs, 1973 Ann. Meetings, v. 5, no. 7, Oct. 1973 p 864-865 Presented at 1973 Ann. Meeting of the Geol. Soc. of Am. Sponsored by NASA ERTS (E74-10184; NASA-CR-136323) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

N74-14996*# Geological Survey, Reston, Va.
SATELLITE GEOLOGICAL AND GEOPHYSICAL REMOTE SENSING OF ICELAND: PRELIMINARY RESULTS OF GEOLOGIC, HYDROLOGIC, OCEANOGRAPHIC, AND AGRICULTURAL STUDIES WITH ERTS-1 IMAGERY Special Report No. 2
Richard S. Williams, Jr., Principal Investigator, Agust Boeovarsson (Icelandic Surveying Dept.), Sturla Friorikssom (Agr. Res. Inst., Iceland), Guomundur Palmason (Natl. Energy Authority, Iceland), Sigurjon Rist (Natl. Energy Authority), Hlynur Sigtryggsson (Icelandic Meteorol. Serv.), Kristjan Saemundsson (Natl. Energy Authority), Sigurour Thorarinsson (Iceland Univ.), and Ingvi Thorsteinsson (Agr. Res. Inst.) 1 Dec. 1973 20 p refs Repr. from Proc. of Symp. on Management and Utilization of Remote Sensing Data, 29 Oct. - 1 Nov. 1973 p 17-35 Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E74-10185; NASA-CR-136324) Avail: NTIS HC $3.00 CSCL 08G

The author has identified the following significant results. The wide variety of geological and geophysical phenomena which can be observed in Iceland, and particularly their very direct relation to the management of the country's natural resources, has provided great impetus to the use of ERTS-1 imagery to measure and map the dynamic natural phenomena in Iceland. MSS imagery is being used to study a large variety of geological and geophysical eruptive products, geologic structure, volcanic geomorphology, hydrologic, oceanographic, and agricultural phenomena of Iceland. Some of the preliminary results from this research projects are: (1) a large number of geological and volcanic features can be studied from ERTS-1 imagery, particularly imagery acquired at low sun angle, which had not previously been recognized; (2) under optimum conditions the ERTS-1 satellite can discern geothermal areas by their snow melt pattern or warm spring discharge into frozen lakes; (3) various maps at scales of 1:1 million and 1:500,000 can be updated and made more accurate with ERTS-1 imagery; (4) the correlation of water reserves with snowcover can improve the basis for planning electrical production in the management of water resources; (5) false-color composites (MSS) permitted the mapping of four types

of vegetation: forested; grasslands, reclaimed, and cultivated areas, and the seasonal change of the vegetation, all of high value to rangeland management.

N74-14997*# Centre for Overseas Pest Research, London (England).
TESTING FEASIBILITY OF DETECTING POTENTIAL LOCUST BREEDING SITES BY SATELLITE Final Report, Jul. 1972 - Aug. 1973
D. E. Pedgley, Principal Investigator Sep. 1973 27 p refs Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E74-10193; NASA-CR-136364) Avail: NTIS HC $3.50 CSCL 08C

There are no author-identified significant results in this report.

N74-14998*# Alaska Univ., Fairbanks. Geophysical Inst.
SEISMICALLY ACTIVE STRUCTURAL LINEAMENTS IN SOUTH-CENTRAL ALASKA AS SEEN ON ERTS-1 IMAGERY Interim Scientific Report
Larry Gedney, Principal Investigator and James VanWormer 30 Nov. 1973 8 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21833)
(E74-10194; NASA-CR-136367) Avail: NTIS HC $3.00 CSCL 08E

The author has identified the following significant results. A mosaic of south-central Alaska composed of 19 ERTS-1 images, when compared with the seismicity pattern of the area, reveals that the larger earthquakes tend to fall on lineaments which are easily recognizable on the imagery. In most cases, these lineaments have not been mapped as faults. One particular lineament, which was the scene of three earthquakes of magnitude 4 or greater during 1972, passes very close to Anchorage.

N74-14999*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
AN INTERDISCIPLINARY ANALYSIS OF MULTISPECTRAL SATELLITE DATA FOR SELECTED COVER TYPES IN THE COLORADO MOUNTAINS, USING AUTOMATIC DATA PROCESSING TECHNIQUES Monthly Progress Report, Oct. 1973
Roger M. Hoffer, Principal Investigator Oct. 1973 6 p Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-13380)
(E74-10195; NASA-CR-136368) Avail: NTIS HC $3.00 CSCL 05B

There are no author-identified significant results in this report.

N74-15000*# Oregon State Univ., Corvallis.
THE COMPARATIVE EVALUATION OF ERTS-1 IMAGERY FOR RESOURCE INVENTORY IN LAND USE PLANNING Interim Report, Mar. - Aug. 1973
G. H. Simonson, Principal Investigator, D. P. Paine, R. D. Lawrence, W. T. Pyott, J. H. Herzog, R. J. Murray, J. A. Norgren, J. A. Cornwell, and R. A. Rogers Nov. 1973 110 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Ave., Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21831)
(E74-10196; NASA-CR-136369) Avail: NTIS HC $7.50 CSCL 08B

The author has identified the following significant results. Multidiscipline team interpretation and mapping of resources for Crook County is nearly complete on 1:250,000 scale enlargements of ERTS-1 imagery. Maps of geology, landforms, soils and vegetation-land use are being interpreted to show limitations, suitabilities and geologic hazards for land use planning. Mapping of lineaments and structures from ERTS-1 imagery has shown a number of features not previously mapped in Oregon. A timber inventory of Ochoco National Forest has been made. Inventory of forest clear-cutting practices has been successfully demonstrated with ERTS-1 color composites. Soil tonal differences in fallow fields shown on ERTS-1 correspond with major soil boundaries in loess-mantled terrain. A digital classification system used for discriminating natural vegetation and geologic materials classes has been successful in separation of most major classes around Newberry Cauldera, Mt. Washington and Big Summit Prairie. Computer routines are available for correction of scanner data variations; and for matching scales and coordinates between digital and photographic imagery. Methods of Diazo film color printing of computer classifications and elevation-slope perspective plots with computer are being developed.

N74-15001*# Grumman Ecosystems Corp., Bethpage, N.Y.
ERTS-1 VIRGIN ISLANDS EXPERIMENT 589: DETERMINE BOUNDARIES OF ERTS AND AIRCRAFT DATA WITHIN WHICH USEFUL WATER QUALITY INFORMATION CAN BE OBTAINED Final Report, Jul. 1972 - Oct. 1973
W. C. Coulbourn, W. G. Egan (Grumman Aerospace Corp.), D. A. Olsen, Principal Investigators (Marine Resources Develop. Found.), and G. B. Heaslip (Grumman Data Systems Corp.) Oct. 1973 255 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21811)
(E74-10197; NASA-CR-136362) Avail: NTIS HC $14.75 CSCL 08H

The author has identified the following significant results. The boundaries of application of ERTS-1 and aircraft data are established for St. Thomas harbor within which useful water quality information can be obtained. In situ physical, chemical, and biological water quality and benthic data were collected. Moored current meters were employed. Optical measurements of solar irradiance, color test panel radiance and water absorption were taken. Procedures for correlating in situ optical, biological, and chemical data with underflight aircraft I2S data and ERTS-1 MSS scanner data are presented. Comparison of bulk and precision CCT computer printout data for this application is made, and a simple method for geometrically locating bulk data individual pixels based on land-water interface is described. ERTS spacecraft data and I2S aircraft imagery are correlated with optical in situ measurements of the harbor water, with the aircraft green photographic and ERTS-1 MSS-4 bands being the most useful. The biological pigments correlate inversely with the optical data for inshore areas and directly further seaward. Automated computer data processing facilitated analysis.

N74-15002* Grumman Ecosystems Corp., Bethpage, N.Y.
SUMMARY OF ERTS-1 VIRGIN ISLANDS EXPERIMENT 589
W. C. Coulbourn, Principal Investigator *In its* ERTS-1 Virgin Islands Expt. 589. Determine Boundaries of ERTS and Aircraft Data Within Which Useful Water Quality Information Can Be Obtained Oct. 1973 42 p Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(For availability see N74-15001 06-13)
CSCL 08H

There are no author-identified significant results in this report.

N74-15003* Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
CORRELATION OF ERTS-1 AND AIRCRAFT OPTICAL DATA WITH WATER QUALITY PARAMETERS OF CHARLOTTE AMALIE HARBOR, ST. THOMAS, VIRGIN ISLANDS
W. C. Coulbourn (Grumman Ecosystems Corp.) and W. G. Egan, Principal Investigators *In* Grumman Ecosystems Corp. ERTS-1 Virgin Islands Expt. 589. Determine Boundaries of ERTS and Aircraft Data Within Which Useful Water Quality Information Can Be Obtained Oct. 1973 65 p refs ERTS (For availability see N74-15001 06-13)
CSCL 08H

The author has identified the following significant results. Attempts to correlate optical aircraft remote sensing of water quality with the optical data from the ERTS-1 satellite using calibrated imagery of Charlotte Amalie harbor, St. Thomas, Virgin Islands are reported. The harbor at Charlotte Amalie has a concentration of a number of factors affecting water quality:

untreated sewage, land runoff, and sediment from navigation and dredging operations. Calibration procedures have been originated and applied to ERTS-1 and I2S camera imagery. The results indicate that the ERTS-1 and I2S imagery are correlated with optical in situ measurements of the harbor water. The aircraft green photographic and ERTS-1 MSS-4 bands have been found most suitable for monitoring the scattered light levels under the conditions of the investigation. The chemical parameters of the harbor water were found to be correlated to the optical properties for two stations investigated in detail. The biological properties of the harbor water (chlorophyll and carotenoids), correlate inversely with the optical data near the pollution sources compared to further away. Calibration procedures developed in this investigation were essential to the interpretation of the photographic and ERTS-1 photometric responses.

N74-15004* Marine Resources Development Foundation, San German (Puerto Rico).
WATER QUALITY PARAMETERS OF HARBORS OF CHARLOTTE AMALIE, ST. THOMAS, VIRGIN ISLANDS: ACQUISITION OF IN SITU WATER DATA, INTERCORRELATION OF SELECTED WATER PARAMETERS, AND INITIAL CORRELATION OF THESE IN SITU BIOLOGICAL, CHEMICAL AND PHYSICAL DATA WITH ERTS-1 BULK CCT MSS BAND 5 DATA
W. C. Coulbourn (Grumman Ecosystems Corp.) and David A. Olsen, Principal Investigators *In* Grumman Ecosystems Corp. ERTS-1 Virgin Islands Expt. 589. Determine Boundaries of ERTS and Aircraft Data Within Which Useful Water Quality Information Can Be Obtained Oct. 1973 54 p refs ERTS (For availability see N74-15001 06-13)

The author has identified the following significant results. Remote sensing by the ERTS-1 satellite was compared with selected water quality parameters including pH, salinity, conductivity, dissolved oxygen, water depth, water temperature, turbidity, plankton concentration, current variables, chlorophylla, total carotenoids, and species diversity of the benthic community. Strong correlation between turbidity and MSS-sensed radiance was recorded and less strong correlations between the two plankton pigments and radiance. Turbidity and benthic species diversity were highly correlated furnishing an inferential tie between an easily sensed water quality variable and a sensitive indicator of average water quality conditions.

N74-15005* Grumman Data Systems Corp., Bethpage, N.Y.
DATA PROCESSING FOR THE ERTS-1 VIRGIN ISLANDS EXPERIMENT 589
W. C. Coulbourn, Principal Investigator (Grumman Ecosystems Corp.) and George B. Heaslip *In* Grumman Ecosystems Corp. ERTS-1 Virgin Islands Expt. 589. Determine Boundaries of ERTS and Aircraft Data Within Which Useful Water Quality Information Can Be Obtained Oct. 1973 71 p Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N74-15001 06-13)
CSCL 08H

There are no author-identified significant results in this report.

N74-15006*# RAND Corp., Santa Monica, Calif.
APPLICABILITY OF ERTS TO ANTARCTIC ICEBERG RESOURCES
John L. Hult, Principal Investigator and Neill C. Ostrander Dec. 1973 26 p refs Presented at 3d ERTS-1 Symp., Washington, D. C., 10-13 Dec. 1973 Sponsored in part by NSF Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21905)
(E74-10198; NASA-CR-136363; P-5137) Avail: NTIS HC $3.50 CSCL 08L

The author has identified the following significant results. This investigation explorers the applicability of ERTS to (1) determine the Antarctic sea ice and environmental behavior that may influence the harvesting of icebergs, and (2) monitor iceberg locations, characteristics, and evolution. Imagery has shown that the potential applicability of ERTS to the research, planning, and harvesting operations can contribute importantly to the glowing promise derived from broader scope studies for the use of Antarctic icebergs to relieve a growing global thirst for fresh water. Several years of comprehensive monitoring will be necessary to characterize sea ice and environmental behavior and iceberg evolution. Live ERTS services will assist harvesting control and claiming operations and offer a means of harmonizing entitlements of iceberg resources. The valuable ERTS services will be more cost effective than other means will be easily justified and borne by the iceberg harvesting operations.

N74-15007*# Battelle Columbus Labs., Ohio.
CALIBRATION AND EVALUATION OF SKYLAB ALTIMETRY FOR GEODETIC DETERMINATION OF THE GEOID Progress Report, 1-31 Dec. 1973
A. G. Mourad and D. M. J. Fubara, Principal Investigators 17 Jan. 1974 9 p ref EREP
(Contract NAS9-13276)
(E74-10199; NASA-CR-136381; PR-10) Avail: NTIS HC $3.00 CSCL 08E

There are no author-identified significant results in this report.

N74-15008*# RAND Corp., Santa Monica, Calif.
APPLICABILITY OF ERTS FOR SURVEYING ANTARCTIC ICEBERG RESOURCES Final Report, Feb. - Jul. 1973
John C. Hult, Principal Investigator and Neill C. Ostrander Nov. 1973 58 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21905; Grant NSF GI-34981)
(E74-10200; NASA-CR-136382; R-1354-NASA/NSF) Avail: NTIS HC $5.00 CSCL 08L

The author has identified the following significant results. This investigation explores the applicability of ERTS to (1) determine the Antarctic sea ice and environmental behavior that may influence the harvesting of icebergs, and (2) monitor iceberg locations, characteristics, and evolution. From image sampling, it is found that the potential applicability of ERTS to the research, planning, and harvesting operations can contribute importantly to the promise derived from broader scope studies for the use of Antarctic icebergs to relieve a growing global thirst for fresh water. Thermal sensor bands will provide coverage in daylight and darkness. Several years of comprehensive monitoring will be necessary to characterize sea ice and environmental behavior and iceberg evolution. Live ERTS services will assist harvesting control and claiming operations and offer a means for harmonizing entitlements to iceberg resources. The valuable ERTS services will be more cost effective than other means and will be easily justified and borne by the iceberg harvesting operation.

N74-15009*# Earth Satellite Corp., Berkeley, Calif.
PLAN FOR THE UNIFORM MAPPING OF EARTH RESOURCES AND ENVIRONMENTAL COMPLEXES FROM SKYLAB IMAGERY Monthly Plans and Progress Report, 1-31 Dec. 1973
Charles E. Poulton, Principal Investigator 31 Dec. 1973 11 p EREP
(Contract NAS9-13286)
(E74-10201; NASA-CR-136383; PR-11) Avail: NTIS HC $3.00 CSCL 08B

The author has identified the following significant results. Below approximately 25% cover visual photointerpretation of vegetation analogs of Skylab 2 SI9OA color infrared imagery is poor. Correct identifications of vegetation analogs in this category range from 28 to 57%. Good photointerpretation results (64 to 96%) were obtained on vegetation analogs with higher cover values. The four semidesert vegetation analogs (greasewood, saltbush, big sagebrush, and pinyon-juniper) are consistently distinguishable as a group. Photointerpretation accuracy equals 90.1%. When these same types are broken into two sub-groups (salt desert vegetation and shrub steppe/sparse pinyon-juniper vegetation) interpretation success drops to 76% and 85%, respectively. Band ratioing and transmittance differences between two forested analogs as imaged on Skylab 2 S19OA film shows significant differences. In the infrared wavelength both analogs have very similar transmittance characteristics while the visible wavelength shows separation between the two. Relative

transmittance values for stands of ponderosa pine forestland and pinyon-juniper woodland are 719.3 + or - 65.9 and 223.6 + or - 48.1, respectively on negative transparencies. In image interpretation along the low-elevation fringe of forested regions these are the two forest analogs most frequently requiring separation.

N74-15010*# Colorado School of Mines, Golden. Dept of Geology.
GEOLOGIC AND MINERAL AND WATER RESOURCES INVESTIGATIONS IN WESTERN COLORADO, USING SKYLAB EREP DATA Monthly Progress Report, Dec. 1973
Keenan Lee, Principal Investigator 17 Jan. 1974 5 p EREP
(Contract NAS9-13394)
(E74-10202; NASA-CR-136384) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

N74-15011*# Nevada Univ., Reno. Mackay School of Mines.
THE GREAT BASIN INVESTIGATION Monthly Progress Report, Dec. 1973
Jack G. Quade, Principal Investigator Dec. 1973 2 p EREP
(Contract NAS9-13274)
(E74-10203; NASA-CR-136385) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

N74-15012*# Delaware Univ., Newark. Coll. of Marine Studies.
SKYLAB/EREP APPLICATION TO ECOLOGICAL, GEOLOGICAL AND OCEANOGRAPHIC INVESTIGATIONS OF DELAWARE BAY Bimonthly Technical Letter Progress Report, Dec. 1973 Jan. 1974
V. Klemas, Principal Investigator 16 Jan. 1974 4 p refs EREP
(Contract NAS1-12304)
(E74-10204; NASA-CR-136386) Avail: NTIS HC $3.00 CSCL 08J

The author has identified the following significant results. A program has been developed to correct geometric distortion of pictures reconstructed from MSS tapes. Coastal vegetation species, land use, water turbidity and current circulation were clearly discernible in Skylab pictures of September 12, 1973. Remarkably high spatial resolution was attained.

N74-15013*# Argus Exploration Co., Los Angeles, Calif.
FAULT PATTERN AT THE NORTHERN END OF THE DEATH VALLEY - FURNACE CREEK FAULT ZONE, CALIFORNIA AND NEVADA
Mark A. Liggett, Principal Investigator and John F. Childs Jan. 1974 10 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21809)
(E74-10205; NASA-CR-136387) Avail: NTIS HC $3.00 CSCL 08E

The author has identified the following significant results. The pattern of faulting associated with the termination of the Death Valley-Furnace Creek Fault Zone in northern Fish Lake Valley, Nevada was studied in ERTS-1 MSS color composite imagery and color IR U-2 photography. Imagery analysis was supported by field reconnaissance and low altitude aerial photography. The northwest-trending right-lateral Death Valley-Furnace Creek Fault Zone changes northward to a complex pattern of discontinuous dip slip and strike slip faults. This fault pattern terminates to the north against an east-northeast trending zone herein called the Montgomery Fault Zone. No evidence for continuation of the Death Valley-Furnace Creek Fault Zone is recognized north of the Montgomery Fault Zone. Penecontemporaneous displacement in the Death Valley-Furnace Creek Fault Zone, the complex transitional zone, and the Montgomery Fault Zone suggests that the systems are genetically related. Mercury mineralization appears to have been localized along faults recognizable in ERTS-1 imagery within the transitional zone and the Montgomery Fault Zone.

N74-15014*# Argus Exploration Co., Los Angeles, Calif.
PAHRANAGAT SHEAR SYSTEM, LINCOLN COUNTY, NEVADA
Mark A. Liggett, Principal Investigator and Helmut E. Ehrenspreck Jan. 1974 12 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21809)
(E74-10206; NASA-CR-136388) Avail: NTIS HC $3.00 CSCL 08E

The author has identified the following significant results. A structural model which relates strike-slip deformation to Basin Range extensional tectonics was formulated on the basis of analysis and interpreatation of ERTS-1 MSS imagery over southern Lincoln County, Nevada. Study of published geologic data and field reconnaissance of key areas has been conducted to support the ERTS-1 data interpretation. The structural model suggests that a left-lateral strike-slip fault zone, called the Pahranagat Shear System, formed as a transform fault separating two areas of east-west structural extension.

N74-15015*# Argus Exploration Co., Los Angeles, Calif.
A RECONNAISSANCE SPACE SENSING INVESTIGATION OF CRUSTAL STRUCTURE FOR A STRIP FROM THE EASTERN SIERRA NEVADA TO THE COLORADO PLATEAU Progress Report, 1 Jul. - 31 Dec. 1973
Mark A. Liggett, Principal Investigator et al Jan. 1974 26 p refs ERTS
(Contract NAS5-21809)
(E74-10207; NASA-CR-136389) Avail: NTIS HC $3.50 CSCL 08E

The author has identified the following significant results. Research progress in an investigation using ERTS-1 MSS imagery to study regional tectonics and related natural resources is summarized. Field reconnaissance guided by analysis of ERTS-1 imagery has resulted in development of a tectonic model relating strike-slip faulting to crustal extension in the southern Basin Range Province. The tectonics of the northern Death Valley-Furnace Creek Fault Zone and spacially associated volcanism and mercury mineralization were also investigated. Field work in the southern Sierra Nevada has confirmed the existence of faults and diabase dike swarms aligned along several major lineaments first recognized in ERTS-1 imagery. Various image enhancement and analysis techniques employed in the study of ERTS-1 data are summarized.

N74-15016*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
AN INTERDISCIPLINARY ANALYSIS OF MULTISPECTRAL SATELLITE DATA FOR SELECTED COVER TYPES IN THE COLORADO MOUNTAINS, USING AUTOMATIC DATA PROCESSING TECHNIQUES Monthly Progress Report, Dec. 1973
Roger M. Hoffer, Principal Investigator Dec. 1973 5 p EREP
(Contract NAS9-13380)
(E74-10208; NASA-CR-136390) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N74-15017*# Research Triangle Inst., Research Triangle Park, N.C.
[RADAR BACKSCATTERING AS A MEANS FOR MEASURING OCEAN SURFACE PARAMETERS USING S193 ALTIMETRY AND S190B PHOTOGRAPHY] Monthly Progress Report, 1-31 Dec. 1973
Charles L. Britt, Jr., Principal Investigator 16 Jan. 1974 1 p EREP
(Contract NAS9-13304)
(E74-10209; NASA-CR-136391) Avail: NTIS HC $3.00 CSCL 08J

There are no author-identified significant results in this report.

N74-15018*# Environmental Research Inst. of Michigan, Ann Arbor.
STUDY OF RECREATIONAL LAND AND OPEN SPACE USING SKYLAB IMAGERY Monthly Progress Report, Dec

1973
Irvin J. Sattinger, Principal Investigator 8 Jan. 1974 2 p EREP
(Contract NAS9-13283)
(E74-10210; NASA-CR-136392; ERIM-103300-17-L) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N74-15019*# Department of Agriculture, Washington, D.C. Statistical Reporting Service.
CROP IDENTIFICATION AND ACREAGE MEASUREMENT UTILIZING ERTS IMAGERY Progress Report, 20 Jun. - 19 Dec. 1973
Donald H. VonSteen, Principal Investigator 19 Dec. 1973 46 p ERTS
(NASA Order S-70251-AG-3)
(E74-10211; NASA-CR-136393) Avail: NTIS HC $4.50

The author has identified the following significant results. Results of temporal overlays, equal and unequal prior probabilities, and independent test data are discussed. The amount of improvement that each technique contributed are summarized: (1) Results in Missouri where temporal overlays were made, show that temporal information improved the overall classification by 10%. (2) The dates were not optimum that were overlaid. (3) Data analysis in both Missouri and Idaho indicates that the use of prior probabilities improves the overall classification rates by at least 10% overusing the assumption that the crops are all equally likely. (4) Using both procedures together indicates that overall performance can be improved by 20% over one data and equal prior probabilities. (5) Idaho data has banding problems that may have caused serious problems in the crop classification. (6) The twelve crop types in Idaho seem to be quite similar spectrally, and hence, classification is quite difficult. (7) ERTS may not contain enough information to have perfect classification, but the data may still be useful for making crop acreage estimates. (8) Remotely sensed data could be used with a regression estimator if there is a correlation between ground data and classification results. (9) Remotely sensed data could be used with a double sample model.

N74-15020*# Servicio Geologico de Bolivia, La Paz.
PETROLEUM EXPLORATION SUBPROGRAM: GEOLOGICAL INTERPRETATION OF PROPORTIONAL IMAGERY FROM ERTS-A SATELLITE [SUB PROGRAMA EXPLORACION PETROLERA: INTERPRETACION GEOLOGICA DE IMAGENES PROPORCIO NADAS POR EL SATELITE ERTS-A]
C. E. Brockmann, Principal Investigator and Carlos Vargas Flores 30 Nov. 1973 14 p In SPANISH Sponsored by NASA ERTS
(E74-10213; NASA-CR-136476) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

N74-15021*# Servicio Geologico de Bolivia, La Paz.
HYDROLOGY SUBPROGRAM: PRELIMINARY STUDY OF THE SALAR DE UYUNI AND COIPASA REGION [SUBPROGRAMA HIDROLOGIA ESTUDIO PRELIMINAR DE LA REGION SALAR DE UYUNIY COIPASA]
C. E. Brockmann, Principal Investigator and G. Mateo Ilijic [1973] 14 p In SPANISH Sponsored by NASA ERTS
(E74-10214; NASA-CR-136477) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N74-15022*# Servicio Geologico de Bolivia, La Paz.
GEOMORPHOLOGY SUBPROGRAM: GEOMORPHOLOGICAL MAP OF OCCIDENTAL REGION OF BOLIVIA, UTILIZING ERTS IMAGERY [SUB-PROGRAMA GEOMORFOLOGIA: BOSQUEJO GEOMORFOLOGICO DE LA REGION OCCIDENTAL DE BOLIVIA UTILIZANDO IMAGENES ERTS]
C. E. Brockmann, Principal Investigator and M. Milton Suarez 6 Nov. 1973 14 p In SPANISH; ENGLISH summary Sponsored by NASA ERTS
(E74-10215; NASA-CR-136478) Avail: NTIS HC $3.00 CSCL 08E

The author has identified the following significant results. Due to the receipt of ERTS-1 imagery, Bolivia will have for the first time a geomorphological map at a scale of 1:100,000. Now the researcher and the student will be able to compare the distribution of the existing shapes of the country, which have been modelled by diverse processes, factors, and agents. This geomorphological information will be very useful in its application to mining, especially alluvial beds, engineering work, and other geological studies. This map is divided into ten geomorphological units which coincide with the geostructural units of the western region of the country.

N74-15023*# Servicio Geologico de Bolivia, La Paz.
SPACE PHOTOMAP OF THE SUBRE - BOLIVIA REGION
C. E. Brockmann, Principal Investigator and F. Ocampo Villa [1973] 10 p Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data, Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E74-10216; NASA-CR-136479) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N74-15024*# Servicio Geologico de Bolivia, La Paz.
REGIONAL GEOLOGY SUBPROGRAM: GEOLOGICAL INTERPRETATION OF ERTS IMAGERY OF THE OCCIDENTAL REGION OF BOLIVIA [SUB-PROGRAMA GEOLOGIA REGIONAL INTERPRETACION GEOLOGICA DE IMAGENES ERTS REGION - OCCIDENTAL DE BOLIVIA]
C. E. Brockmann, Principal Investigator and Raul Ballon Ayllon 30 Oct. 1973 24 p In SPANISH; ENGLISH summary Sponsored by NASA ERTS
(E74-10217; NASA-CR-136480) Avail: NTIS HC $3.25 CSCL 08G

The author has identified the following significant results. Using ERTS-1 imagery, it is possible to delimit great lithological units, folds, lineaments, faults, and in lesser degree unconformities. In the morphological aspect, the images show clearly the relief necessary for geological interpretation. The ERTS-1 images are important for the preparation of the geological and tectonic map of Bolivia, on a 1:1 million scale, if conventional methods of work are used as a base.

N74-15025*# Servicio Geologico de Bolivia, La Paz.
VOLCANISM SUBPROGRAM: VOLCANOLOGICAL INTERPRETATION OF THE NORTHERN PART OF THE OCCIDENTAL CORDILLERA OF BOLIVIA, UTILIZING ERTS IMAGERY [SUB-PROGRAMA VULCANISMO: INTERPRETACION VULCANOLOGICA DE LA PARTE SEPTENTRIONAL DE LA CORDILLERA OCCIDENTAL DE BOLIVIA, UTILIZANDO IMAGENES ERTS]
C. E. Brockmann, Principal Investigator and Siegfried Kussmaul 26 Oct. 1973 17 p refs In SPANISH; ENGLISH summary Sponsored by NASA ERTS
(E74-10218; NASA-CR-136481) Avail: NTIS HC $3.00 CSCL 08F

The author has identified the following significant results. In the present study, 6 ERTS-1 images have been interpreted on a 1:1 million scale (black and white) with the respective field reconnaissance. The area studied is located in the region bordering with Chile and includes the western part of the Bolivian Altiplano, the volcano Cordillera (western cordillera) and the northern part of Chile to the Pacific Coast. The greater part of this region is formed by Pliocene/Pleistocene volcani rock, which is discordant with the Tertiary sediments with intercalations of calcareous tuff. The ERTS-1 imagery permits the tracing of regional boundaries of the great volcanic formations and the alinements of the volcanic bodies along the fault zones. They also permit a clear examination of the volcanic apparatus, including their secondary forms, such as lava flows, parasitic cones, and lava domes. Because of the great scale, it is not possible to identify either the small structures or those of low relief. On the basis of the interpretation of the images, it is possible to give an idea of the relative age of the volcanoes.

N74-15026*# Geological Survey, Reston, Va.
OVERALL EVALUATION OF SKYLAB (EREP) IMAGES FOR CARTOGRAPHIC APPLICATION Progress Report, 1 Aug. - 31 Dec. 1973
Alden P. Colvocoresses, Principal Investigator 1 Jan. 1974 2 p EREP
(NASA Order T-5395-B)
(E74-10220; NASA-CR-136483) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N74-15027*# Earth Satellite Corp., Berkeley, Calif.
PLAN FOR THE UNIFORM MAPPING OF EARTH RESOURCES AND ENVIRONMENTAL COMPLEXES FROM SKYLAB IMAGERY Monthly Progress Report, 1-30 Nov. 1973
Charles E. Poulton, Principal Investigator 30 Nov. 1973 9 p EREP
(Contract NAS9-13286)
(E74-10222; NASA-CR-136485; MPR-10) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N74-15028*# Corps of Engineers, Waltham, Mass.
ERTS-1 DATA USER INVESTIGATION OF THE USE OF ERTS IMAGERY IN RESERVOIR MANAGEMENT AND OPERATION Progress Report, 14 Aug. 14 Oct. 1973
Saul Cooper and Paul Bock, Principal Investigators 15 Dec. 1973 7 p ERTS
(NASA Order S-70256-AG)
(E74-10223; NASA-CR-136486; PR-8) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N74-15029*# Colorado School of Mines, Golden. Dept. of Geology.
GEOLOGIC AND MINERAL AND WATER RESOURCES INVESTIGATIONS IN WESTERN COLORADO, USING SKYLAB EREP DATA Monthly Progress Report, Nov. 1973
Keenan Lee, Principal Investigator 14 Dec. 1973 5 p EREP
(Contract NAS9-13394)
(E74-10224; NASA-CR-136487) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N74-15030*# Michigan State Univ., East Lansing.
INVESTIGATION OF SKYLAB DATA Monthly Plans and Progress Report, Nov. 1973
Lester V. Manderscheid, Principal Investigator Nov. 1973 4 p EREP
(Contract NAS9-13332)
(E74-10225; NASA-CR-136488) Avail: NTIS HC $3.00 CSCL 05B

There are no author-identified significant results in this report.

N74-15031*# Geological Survey, Denver, Colo.
REMOTE SENSING GEOPHYSICS FROM SKYLAB Monthly Report, Dec. 1973
Kenneth Watson, Principal Investigator Dec. 1973 3 p EREP
(NASA Order T-6555-B)
(E74-10226; NASA-CR-136489) Avail: NTIS HC $3.00 CSCL 08E

There are no author-identified significant results in this report.

N74-15032*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
AN INTERDISCIPLINARY ANALYSIS OF MULTISPECTRAL SATELLITE DATA FOR SELECTED COVER TYPES IN THE COLORADO MOUNTAINS, USING AUTOMATIC DATA PROCESSING TECHNIQUES Monthly Progress Report, Nov. 1973
Roger M. Hoffer, Principal Investigator Nov. 1973 6 p EREP
(Contract NAS9-13380)
(E74-10227; NASA-CR-136490) Avail: NTIS HC $3.00 CSCL 05B

There are no author-identified significant results in this report.

N74-15033*# Kennecott Exploration, Inc., Salt Lake City, Utah. Exploration Services Dept.
RECOGNITION OF THE GEOLOGIC FRAMEWORK OF PORPHYRY DEPOSITS ON ERTS-1 IMAGERY Progress Report, Jul. - Dec. 1973
John C. Wilson, Principal Investigator 18 Jan. 1974 5 p ERTS
(Contract NAS5-21769)
(E74-10228; NASA-CR-136491) Avail: NTIS HC $3.00 CSCL 08G

The author has identified the following significant results. Three major tectonic provinces have been mapped by geologic photointerpretation of ERTS-1 imagery over the Ok Tedi test site. These areas can be characterized as follows: (1) A broad area of low relief and mature topography suggesting a history of relative tectonic stability. (2) A narrow belt of moderate to high relief, broad open folds and prominent linear features. The Mount Fubilan-type porphyry copper deposits and recent volcanic effusive centers occur in this province. (3) A heterogeneous zone of high relief and high drainage density suggestive of relative structural complexity.

N74-15034*# Kansas Univ. Center for Research, Inc., Lawrence.
KANSAS ENVIRONMENTAL AND RESOURCE STUDY: A GREAT PLAINS MODEL Progress Report, Oct. - Nov. 1973
R. M. Haralick, E. T. Kanemasu, S. A. Morain, H. L. Yarger, Fawwaz T. Ulaby, John C. Davis, Principal Investigators, Robert J. Bosley, Donald L. Williams, James R. McCauley, and James L. McNaughton Dec. 1973 62 p refs ERTS
(Contract NAS5-21822)
(E74-10229; NASA-CR-136492) Avail: NTIS HC $5.25 CSCL 08F

The author has identified the following significant results. Improvement in the land use classification accuracy of ERTS-1 MSS multi-images over Kansas can be made using two distances between neighboring grey tone N-tuples instead of one distance. Much more information is contained texturally than spectrally on the Kansas image. Ground truth measurements indicate that reflectance ratios of the 545 and 655 nm wavebands provide an index of plant development and possibly physiological stress. Preliminary analysis of MSS 4 and 5 channels substantiate the ground truth interpretation. Results of the land use mapping experiment indicate that ERTS-1 imagery has major potential in regionalization. The ways in which land is utilized within these regions may then be studied more effectively than if no adequate regionalization is available. A model for estimating wheat yield per acre has been applied to acreage estimates derived from ERTS-1 imagery to project the 1973 wheat yields for a ten county area in southwest Kansas. The results are within 3% of the preharvest estimates for the same area prepared by the USDA. Visual identification of winter wheat is readily achieved by using a temporal sequence of images. Identification can be improve by stratifying the project area into subregions having more or less homogeneous agricultural practices and crop mixes.

N74-15035*# Science and Technology Agency, Tokyo (Japan).
APPLICATION OF ERTS DATA TO THE DETECTION OF THIN CIRRUS AND CLEAN AIR TURBULENCE Progress Report, Jul. 1972 - Aug. 1973
Kiyoshi Tsuchiya, Principal Investigator Oct. 1973 4 p Presented at ERTS Symp., Greenbelt, Md., 5-9 Mar. 1973 Sponsored by NASA ERTS
(E74-10230; NASA-CR-136493) Avail: NTIS HC $3.00 CSCL 04B

The author has identified the following significant results. The feasibility of detecting a thin cirrus and clear air turbulence from ERTS-1 MSS data is explored. The result of analyses indicates that a thin cirrus not shown in a conventional meteorological satellite picture can be revealed in ERTS-1 MSS

pictures. Is also found that the core of jet stream can be located with high accuracy from ERTS-1 pictures and the possible area of clear air turbulence can be predicted if the data of the quality of ERTS-1 data are available in real time.

N74-15036*# North Carolina State Univ., Raleigh. Dept. of Geosciences.
UTILIZATION OF EREP DATA IN GEOLOGICAL EVALUATION REGIONAL PLANNING, FOREST MANAGEMENT, AND WATER MANAGEMENT IN NORTH CAROLINA Quarterly Progress Report, Sep. - Nov. 1973
Charles W. Welby, Principal Investigator 11 Jan. 1974 2 p EREP
(Contract NAS9-13321)
(E74-10231; NASA-CR-136494) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N74-15037*# National Marine Fisheries Service, Bay Saint Louis, Miss.
APPLICATION OF REMOTE SENSING FOR FISHERY RESOURCE ASSESSMENT AND MONITORING Monthly Progress Report, 10 Dec. 1973 - 10 Jan. 1974
William H. Stevenson, Principal Investigator 11 Jan. 1974 5 p EREP
(NASA Order T-8217-B)
(E74-10232; NASA-CR-136495; MPR-8) Avail: NTIS HC $3.00 CSCL 08A

There are no author-identified significant results in this report.

N74-15038*# City Coll. of the City of New York. Univ. Inst. of Oceanography.
A JOINT METEOROLOGICAL, OCEANOGRAPHIC AND SENSOR EVALUATION PROGRAM FOR EXPERIMENT S193 ON SKYLAB Monthly Plans and Progress Report, period ending 14 Jan. 1974
Willard J. Pierson, R. K. Moore, and E. P. McClain, Principal Investigators 14 Jan. 1974 3 p EREP
(Contract NAS9-13642)
(E74-10233; NASA-CR-136496) Avail: NTIS HC $3.00 CSCL 14B

There are no author-identified signficant results in this report.

N74-15039*# National Marine Fisheries Service, Bay Saint Louis, Miss. Fisheries Engineering Lab.
APPLICATION OF REMOTE SENSING FOR FISHERY RESOURCE ASSESSMENT AND MONITORING. SKYLAB OCEANIC GAMEFISH PROJECT Monthly Progress Report, 10 Oct. - 10 Nov. 1973
William H. Stevenson, Principal Investigator and K. J. Savastano 14 Nov. 1973 331 p EREP
(NASA Order T-8217-B)
(E74-10234; NASA-CR-136501; MPR-6) Avail: NTIS HC $18.75 CSCL 08A

There are no author-identified significant results in this report.

N74-15040*# Calspan Corp., Buffalo, N.Y.
S190 INTERPRETATION TECHNIQUES DEVELOPMENT AND APPLICATION TO NEW YORK STATE WATER RESOURCES Quarterly Report, 1 Sep. - 30 Nov. 1973
Kenneth R. Piech, Principal Investigator 30 Nov. 1973 5 p refs EREP
(Contract NAS9-13336)
(E74-10235; NASA-CR-136502; QR-3) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N74-15041*# Itek Corp., Lexington, Mass. Optical Systems Div.
AUTOMATED THEMATIC MAPPING AND CHANGE DETECTION OF ERTS-A IMAGES Interim Report, Feb. - Jul. 1973
Nicholas Gramenopoulos, Principal Investigator Aug. 1973 73 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21766)
(E74-10236; NASA-CR-136556) Avail: NTIS HC $5.75 CSCL 08B

The author has identified the following significant results. For the recognition of terrain types, spatial signatures are developed from the diffraction patterns of small areas of ERTS-1 images. This knowledge is exploited for the measurements of a small number of meaningful spatial features from the digital Fourier transforms of ERTS-1 image cells containing 32 x 32 picture elements. Using these spatial features and a heuristic algorithm, the terrain types in the vicinity of Phoenix, Arizona were recognized by the computer with a high accuracy. Then, the spatial features were combined with spectral features and using the maximum likelihood criterion the recognition accuracy of terrain types increased substantially. It was determined that the recognition accuracy with the maximum likelihood criterion depends on the statistics of the feature vectors. Nonlinear transformations of the feature vectors are required so that the terrain class statistics become approximately Gaussian. It was also determined that for a given geographic area the statistics of the classes remain invariable for a period of a month but vary substantially between seasons.

N74-15042*# Cornell Univ., Ithaca, N.Y. Dept. of Natural Resources.
EVALUATION OF SATELLITE IMAGERY AS AN INFORMATION SERVICE FOR INVESTIGATING LAND USE AND NATURAL RESOURCES (SKYLAB) Progress Report, 1-31 Dec. 1973
Ernest E. Hardy, Principal Investigator [1974] 1 p EREP
(Contract NAS9-13364)
(E74-10237; NASA-CR-136535) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N74-15043*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
STUDY OF ATMOSPHERIC EFFECTS IN SKYLAB DATA Quarterly Progress Report Sep. - Nov. 1973
Frederick J. Thomson, Principal Investigator 22 Jan. 1974 3 p EREP
(Contract NAS9-13272)
(E74-10239; NASA-CR-236537; ERIM-101700-11-L; QPR-3) Avail: NTIS HC $3.00 CSCL 04A

There are no author-identified significant results in this report.

N74-15044*# National Oceanic and Atmospheric Administration, Miami, Fla. Environmental Research Labs.
REMOTE DETECTION OF OCEAN FEATURES IN THE LESSER ANTILLES USING ERTS-1 DATA Progress Report
Kirby J. Hanson, Principal Investigator 15 Jan. 1974 24 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Ave., Sioux Falls, S. D. 57198 ERTS
(NASA Order S-70246-AG-1)
(E74-10240; NASA-CR-136538) Avail: NTIS HC $3.25 CSCL 08J

The author has identified the following significant results. Photographic data received from the ERTS-1 satellite over the Lesser Antilles Islands shows distinct ocean features on the leeward side of each island. Attempts to relate these features to ocean eddy formations with the aid of ground truth data proved unsuccessful. However, analysis of surface and upper air wind data correlate extremely well with the size, shape, and downwind extent of the ocean features. Studies to date indicate strongly that these features result from horizontal differences in sea surface roughness due to the wind shadow effect of the islands. The results suggest that horizontal variations in the reflectance of the sea surface will make remote sensing of the ocean mixed layer more difficult than previously anticipated. The surface reflection seems to be large enough to mask the smaller variations in backscattered energy from the mixed layer. Efforts to limit the effect of surface reflectance by photographic

differencing of two MSS bands were unsuccessful. A supplementary study to enhance the energy reflected from the mixed layer through numerical differencing of ERTS-1 digital data is planned.

N74-15045*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
OIL POLLUTION DETECTION, MONITORING AND LAW ENFORCEMENT Quarterly Progress Report
Robert Horvath, Principal Investigator 22 Jan. 1974 3 p EREP
(Contract NAS9-13281)
(E74-10241; NASA-CR-136539; ERIM-101800-8-L; QPR-3) Avail: NTIS HC $3.00 CSCL 08J

There are no author-identified significant results in this report.

N74-15046*# National Oceanic and Atmospheric Administration, Miami, Fla. Altantic Oceanographic and Meteorological Labs.
REMOTE SENSING OF OCEAN CURRENT BOUNDARY LAYER Monthly Progress Report, Dec. 1973
George A. Maul, Principal Investigator Dec. 1973 32 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(NASA Order T-4713-B)
(E74-10242; NASA-CR-136540; MPR-6) Avail: NTIS HC $3.75 CSCL 08C

The author has identified the following significant results. A time series of the Loop Current in the Gulf of Mexico, covering an annual cycle of growth, spreading, and decay, has been obtained in synchronization with ERTS-1. Computer enhanced images, which are necessary to extract useful oceanic information, show that the current can be observed either by color or sea state effects associated with the cyclonic boundary. The color effect relates to the spectral variations in the optical properties of the water and its suspended particles, and is studied by radiative transfer theory. Significant oceanic parameters identified are: the probability of forward scattering, and the ratio of scattering to total attenuation. Several spectra of upwelling diffuse light are computed as a function of the concentration of particles and yellow substance. These calculations compare favorably with experimental measurements and show that the ratio of channels method gives ambiguous interpretative results. These results are used to discuss features in images where surface measurements were obtained and are extended to tentative explanation in others.

N74-15047*# National Oceanic and Atmospheric Administration, Miami, Fla. Altantic Oceanographic and Meteorological Labs.
REMOTE SENSING OF OCEAN CURRENT BOUNDARY LAYER Monthly Report, Nov. 1973
George A. Maul, Principal Investigator Nov. 1973 2 p EREP
(NASA Order T-4713-B)
(E74-10243; NASA-CR-136541; MR-5) Avail: NTIS HC $3.00 CSCL 08C

There are no author-identified significant results in this report.

N74-15048*# Wyoming Univ., Laramie. Dept. of Geology.
APPLICATION OF ERTS IMAGERY TO GEOLOGIC MAPPING IN THE VOLCANIC TERRANE OF NORTHWEST WYOMING Special Report
Roy M. Breckenridge 10 Dec. 1973 24 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21799)
(E74-10244; NASA-CR-136542; ERTS-1-5-73-5) Avail: NTIS HC $3.25 CSCL 08B

The author has identified the following significant results. ERTS-1 image interpretations in the Yellowstone/Absaroka volcanic province indicate that the ERTS-1 imagery can be successfully employed in mapping large-scale structures and gross lithologic differences within the volcanic rocks. The volcanic rocks are readily separable from the sedimentary and crystalline rocks but the various volcanic units are seldom distinguishable unless they exhibit a characteristic morphology. Color anomalies were detected on the ERTS-1 imagery and found to be related to zones of alteration and mineralization. High altitude aircraft imagery provided a means of checking and improving the interpretations.

N74-15049*# Nebraska Univ., Lincoln. Dept. of Agronomy.
EVALUATION OF ERTS-1 IMAGERY IN MAPPING AND MANAGING SOIL AND RANGE RESOURCES IN THE SAND HILLS REGION OF NEBRASKA Progress Report, 1 Jul. - 31 Dec. 1973
James V. Drew, Principal Investigator and Paul M. Seevers 18 Jan. 1974 16 p ERTS
(Contract NAS5-21756)
(E74-10245; NASA-CR-136543) Avail: NTIS HC $3.00 CSCL 08B

The author has identified the following significant results. Interpretations of imagery from the Earth Resources Technology Satellite (ERTS-1) indicate that soil associations and attendant range sites can be identified on the basis of vegetation and topography using multitemporal imagery. Optical density measurements of imagery from the visible red band of the multispectral scanner(MSS band 5) obtained during the growing season were related to field measurements of vegetative biomass, a factor that closely parallels range condition class on specific range sites. ERTS-1 imagery also permitted inventory and assessment of center-pivot irrigation systems in the Sand Hills region in relation to soil and topographic conditions and energy requirements. Four resource maps of the Upper Loup Natural Resource District located entirely within the Sand Hills region were prepared from ERTS-1 imagery.

N74-15050*# Lund Univ. (Sweden). Dept. of Physical Geography.
EVALUATION OF DATA UTILITY FOR EARTH SCIENCES FROM METHODICAL POINT OF VIEW Progress Report, Aug. 1973 - Jan. 1974
Harald Svensson, Sven Behrens, Karl Erik Bergsten, Karna Lidmar-Bergstroem, Sven Lindqvist, Jan Mattsson, and Siw Nordstroem, Principal Investigators 15 Jan. 1974 81 p refs Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E74-10249; NASA-CR-136560) Avail: NTIS HC $6.25 CSCL 05B

There are no author-identified significant results in this report.

N74-15051# Rima (Alessandro), Muralto (Switzerland).
MAXIMUM AND MINIMUM TEMPERATURES TO DEPTHS OF 1.60 m IN GRANULATED SOILS AT BELLINZONA FOR 1965 [TEMPERATURA MASSIMA E MINIMA FINO ALLA PROFONDITA DI 1,60 M, DEL MISTO GRANULARE A BELLINZONA NEL 1965]
Alessandro Rima Jan. 1973 33 p refs In ITALIAN
(RI/sm/25) Avail: NTIS HC $3.75

Daily minimum and maximum soil temperature measurements at depths of 20, 40, 60, 80, 100, 120, 140, and 160 cm are reported. Isotherms for the daily minimum and maximum temperatures are plotted for each level for the entire year. The frost levels are indicated for the winter months.

Transl. by F.O.S.

N74-15052# Physical Research Lab., Ahmedabad (India).
MOLECULAR OXYGEN CONCENTRATIONS AT EQUATORIAL LATITUDES DERIVED FROM SOLAR ULTRA VIOLET ABSORPTION MEASUREMENTS
B. H. Subbaraya, Satya Prakash, Vijay Kumar, and P. N. Pareek [1973] 5 p refs Submitted for publication
(AER-73-06) Avail: NTIS HC $3.00

Nitric oxide filled ion chambers with lithium fluoride window were flown on Nike Apache rockets 10.37 and 10.43 from Thumba to measure the moon time absorption profile of solar Lyman alpha radiation. The results were used to compute molecular oxygen concentrations in the height region 65 to about 95 kms at Thumba. It is found that the measured oxygen concentrations are in general less than the standard atmospheric models of Groves (1970) and show large differences between the two flights in the 80-90 km region. Author

N74-15053# Physical Research Lab., Ahmedabad (India).
MEASUREMENTS OF ELECTRON TEMPERATURES IN THE LOWER IONOSPHERE BY DETECTING THE SPACE POTENTIAL ON THE LANGMUIR PROBE CHARACTERISTIC
B. H. Subbaraya, Satya Prakash, S. P. Gupta, and H. S. S. Sinha [1973] 5 p refs
(AER-73-07) Avail: NTIS HC $3.00

Electron temperatures were determined at Thumba on Nike Apache flight 10.11 (12 March 1967, 1857 hrs. IST) by the usual retarding potential analysis and by using an ac modulation technique for detecting the space potential on the Langmuir probe characteristic. Simultaneous measurements of Te with the two techniques show that the space potential technique gives temperatures which are related to the temperatures obtained from the retarding potential analysis in a manner remarkably similar to the relations obtained between radar temperatures and dc probe temperatures. Since radar temperatures were found to be in good agreement with the temperatures obtained by ac modulation techniques on satellite borne probes and with theoretical predictions on electron temperatures, it is suggested that the space potential technique may prove to be very useful in determining electron temperatures. The technique is simple, requires limited additional electronics, does not make stringent demands on telemetry, and can be easily adopted for rocket borne Langmuir probes. Author

N74-15054# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
CARTOGRAPHIC AND SURVEYING REPORTS. SERIES 1: ORIGINAL STUDIES [NACHRICHTEN AUS DEM KARTEN- UND VERMESSUNGSWESEN. REIHE 1: ORIGINALBEITRAEGE]
1973 42 p refs In GERMAN; ENGLISH summary
(Bull-63) Avail: NTIS HC $4.25

In the past ten years the technological progress in the construction of light aircraft has been extremely great. Its influence on the geosciences, especially on aerial surveying, is studied. Numerous data on modern aircraft are given in table form. Author

N74-15055# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
CARTOGRAPHIC AND SURVEYING REPORTS. SERIES 1: ORIGINAL STUDIES [NACHRICHTEN AUS DEM KARTEN- UND VERMESSUNGSWESEN. REIHE 1: ORIGINALBEITRAEGE]
1973 89 p refs In GERMAN; ENGLISH summary
(Bull-60) Avail: NTIS HC $6.50

The Fertsch effect in photogrammetry is considered by using a usable measure of altimetric error sources in drawing contour lines. 30 topographic geomorphological map samples 1:25,000 are utilized as a basis of computing mean and average values of inclination of banks and terrain slopes; these data are then used for estimating orthophotographic errors. Examples of photographic processing of orthophotographs are included. Author

N74-15056*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
GRAVITATIONAL RADIATION THEORY M.A. Thesis - Rice Univ.
Thomas L. Wilson Dec. 1973 186 p refs
(NASA-TM-X-58132; JSC-08587) Avail: NTIS HC$11.50 CSCL 08N

A survey is presented of current research in the theory of gravitational radiation. The mathematical structure of gravitational radiation is stressed. Furthermore, the radiation problem is treated independently from other problems in gravitation. The development proceeds candidly through three points of view - scalar, rector, and tensor radiation theory - and the corresponding results are stated. Author

N74-15057# Bureau of Mines, Denver, Colo.
DETECTION AND DELINEATION OF FAULTS BY SURFACE RESISTIVITY MEASUREMENTS: GAS HILLS REGION, FREMONT AND NATRONA COUNTIES, WYO.
Robert Lee Stahl 1973 32 p refs
(BM-RI-7824) Avail: NTIS HC $3.75

Comprehensive field tests were made in the Gas Hills, Wyo., to determine whether surface geophysical techniques could be used to detect and delineate faults in marginal uranium deposits. The tests included seismic refraction self-potential, induced polarization, magnetometer, electrical resistivity, airborne infrared thermal scanning, and airborne photography. Of the several geophysical techniques tested in the field, horizontal resistivity profiling with electrode spacings in the range of 25 to 50 feet was most diagnostic of faults. Author

N74-15058*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
NOTES FOR THE IMPROVEMENT OF THE SPATIAL AND SPECTRAL DATA CLASSIFICATION METHOD
Charles C. Dalton 23 Jan. 1974 33 p refs
(NASA-TM-X-64801) Avail: NTIS HC $3.75 CSCL 05B

This report examines the spatial and spectral clustering technique for the unsupervised automatic classification and mapping of earth resources satellite data, and makes theoretical analysis of the decision rules and tests in order to suggest how the method might best be applied to other flight data such as Skylab and Spacelab. Author

N74-15059# Joint Publications Research Service, Arlington, Va.
SURFACE AND INTERNAL WAVES
L. V. Cherkesov 28 Dec. 1973 80 p Transl. into ENGLISH from the book "Poverkhnostnyye i Vnutrenniye Volny" Kiev, Naukova Dumka, 1973 80 p
(JPRS-60867) Avail: NTIS HC $6.00

Data are reported on unsteady state waves generated by moving disturbances and by internal waves caused by moving pressures in a continuously stratified sea. Also described are two methods of investigation of integrals encountered in the theory of unsteady-state ships' waves. Author

N74-15060# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
AN OVERVIEW OF AERONOMIC PROCESSES IN THE STRATOSPHERE AND MESOSPHERE
Marcel Nicolet 4 Dec. 1973 71 p refs
(Grant NSF GA-33446X)
(PSU-IRL-SCI-419) Avail: NTIS HC $5.75

The discrepancy noted between theoretical and observational concentrations of O3 in the mesosphere and stratosphere can be explained by an effect of hydrogen compounds and of nitrogen oxides. Solar radiation dissociates water vapor and methane in the thermosphere and upper mesosphere. In the stratosphere the reaction of the excited oxygen atom with methane and nitrous oxide products carbon monoxide with water vapor and nitric oxide, respectively. Hydrogen and water vapor molecules react also with the electronically excited oxygen atom O(D-1) leading to hydroxyl radicals. In situ sources of H2 exist in the stratosphere and mesosphere: reaction of OH with CH4, photodissociation of formaldehyde and also reaction between hydroperoxyl radicals and hydrogen atoms. The reactions leading to the production and destruction of nitric acid and nitrous acid must be considered. Nitric acid molecules are involved in an eddy diffusion transport from the lower stratosphere into the troposphere and are responsible for the removal of nitric oxide which is produced in the stratospher. Author

N74-15061*# National Aeronautics and Space Administration Goddard Space Flight Center, Greenbelt, Md.
DETECTION OF OCEAN COLOR CHANGES FROM HIGH ALTITUDES
Warren A. Hovis, Michael L. Forman, and Lamdin R. Blaine Nov. 1973 30 p refs Submitted for publication
(NASA-TM-X-70559; X-652-73-371) Avail: NTIS HC $3.50 CSCL 08A

The detection of ocean color changes, thought to be due to chlorophyll concentrations and gelbstoffe variations, is attempted from high altitude (11.3km) and low altitude (0.3km). The atmospheric back scattering is shown to reduce contrast, but not sufficiently to obscure color change detection at high altitudes. Author

N74-15062*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AVERAGE HIGH LATITUDE MAGNETIC FIELD: VARIATIONS WITH INTERPLANETARY SECTOR AND WITH SEASON. 2: COMPARISON OF DISTURBANCE LEVELS AND DISCUSSION OF IONOSPHERIC CURRENTS
R. Langel and Nathan Brown (Maryland Univ., College Park) [1973] 26 p refs
(NASA-TM-X-70563; X-645-73-380) Avail: NTIS HC $3.50 CSCL 08N

Average high latitude magnetic field data from northern observatories are examined for three ranges of magnetic disturbance level, Kp = 1 minus to 1+,2 minus to 3+, and > or = 4 minus. Except for 0-8h MLT, 55-78 deg invariant latitude, during away interplanetary magnetic field sectors, the variations between season and sector have the the same characteristics at all Kp ranges. Because the amplitude of sector differences is much larger at sunlit local times than in the midnight sector, it is concluded that the current system of Svalgaard (1973) is not adequate to describe the sector variations in magnetic disturbance, other current systems are discussed briefly. The disturbance morphology and seasonal variation at all Kp levels confirms the results of previous studies which indicate that latitudinally broad current systems and non-ionospheric sources are present in addition to latitudinally narrow electrojet currents. Comparison of data between Kp levels indicates that the Harang discontinuity shifts toward earlier MLT with increasing Kp level. Author

N74-15063*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GRAVITY MODEL IMPROVEMENT INVESTIGATION
J. W. Siry, W. D. Kahn, J. W. Bryan, and F. F. Vonbun Jan. 1973 15 p refs
(NASA-TM-X-70550; X-590-73-249) Avail: NTIS HC $3.00 CSCL 08N

This investigation was undertaken to improve the gravity model and hence the ocean geoid. A specific objective is the determination of the gravity field and geoid with a space resolution of approximately 5 deg and a height resolution of the order of five meters. The concept of the investigation is to utilize both GEOS-C altimeter and satellite-to-satellite tracking data to achieve the gravity model improvement. It is also planned to determine the geoid in selected regions with a space resolution of about a degree and a height resolution of the order of a meter or two. The short term objectives include the study of the gravity field in the GEOS-C calibration area outlined by Goddard, Bermuda, Antigua, and Cape Kennedy, and also in the eastern Pacific area which is viewed by ATS-F. A.L.

N74-15064*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MAGNETOSPHERIC ELECTRIC FIELD MEASUREMENTS DURING SUDDEN COMMENCEMENTS
T. L. Aggson and T. L. Skillman Jul. 1973 35 p refs Submitted for publication
(NASA-TM-X-70545; X-645-73-211) Avail: NTIS HC $3.75 CSCL 04A

Direction measurements of electric fields were made in the outer magnetosphere during two sudden commencements in 1972. These measurements were observed with the double floating probe experiment carried aboard the IMP 6 satellite. The initial variations of the measured electric field consisted of an increase from a background of about 1 mv/meter to some 10 mv/meter at about 7 rE (earth radi) and to some 4 mv/meter at 3 rE. These initial electric field disturbances were longitudinal, oriented counter clockwise about an axis pointed north. A solution of Maxwell's third equation is derived for these measurements using a quasi-static version of Mead's model of the magnetosphere B (t). This solution seems to describe well the magnitude and direction of the initial perturbation of the electric field vectors observed during these two sudden commencements. After the initial increase, the measured electric field rings several times with periods of the order of minutes. This observed oscillatory behavior correlates with magnetic observatory records taken near the foot of the magetic field line passing through the satellite. Author

N74-15065*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON THE BREAKUP OF TECTONIC PLATES BY POLAR WANDERING
Han-Shou Liu Aug. 1973 28 p refs Submitted for publication
(NASA-TM-X-70549; X-592-73-207) Avail: NTIS HC $3.50 CSCL 08E

The observed boundary system of the major tectonic plates on the surface of the earth lends fresh support to the hypothesis of polar wandering. A dynamic model of the outer shell of the earth under the influence of polar shift is developed. The analysis falls into two parts: (1) deriving equations for stresses caused by polar shifting; and (2) deducing the pattern according to which the fracture of the shell can be expected. For stress analysis, the theory of plates and shells is the dominant feature of this model. In order to determine the fracture pattern, the existence of a mathematical theorem of plasticity is recalled: it says that the plastic flow begins to occur when a function in terms of the differences of the three principal stresses surpasses a certain critical value. By introducing the figures for the geophysical constants, this model generates stresses which could produce an initial break in the lithosphere. Author

N74-15066*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON THE SOURCE OF FLARE-EJECTA RESPONSIBLE FOR GEOMAGNETIC STORMS
Kunitomo Sakurai (Md. Univ.) Jan. 1974 12 p refs
(NASA-TM-X-70567; X-693-74-1) Avail: NTIS HC $3.00 CSCL 04A

It is shown that magnetic bottles as the sources of moving metric type 4 bursts are not responsible for the development of geomagnetic storms, despite the fact that shock waves producing type 2 bursts are the sources of the interplanetary shock waves, which produce SSC's on the geomagnetic field. These magnetic bottles, in general, tend to move in the solar envelope with the speed of several hundred Km/sec at most, which is much slower than that of the motion of type 2 radio sources. Author

N74-15067*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN AURORAL BREAKUP MECHANISM
J. E. Maggs Sep. 1973 54 p refs Submitted for publication
(NASA-TM-X-70553; X-641-73-265) Avail: NTIS HC $4.75 CSCL 04A

A purely growing electrostatic drift instability driven by the electron temperature gradient at the inner edge of the plasma sheet can grow for large enough values of the temperature gradient. The parallel electric field associated with the instability is localized near the magnetic equator. The growth of the drift instability leads to enhanced whistler noise and increased electron pitch angle diffusion. If the current limit is exceeded in the ionosphere while the parallel electric field of the drift instability exists along the field line, rapid electron precipitation (the auroral breakup) can result. Author

N74-15068*# New York Univ., N.Y. School of Engineering and Science.
THE ELEVATION, SLOPE, AND CURVATURE SPECTRA OF A WIND ROUGHENED SEA SURFACE Final Report
Willard J. Pierson, Jr. and Robert A. Stacy Washington NASA Dec. 1973 129 p refs
(Contract NAS1-10090)
(NASA-CR-2247) Avail: NTIS HC $4.50 CSCL 08C

The elevation, slope and curvature spectra are defined as a function of wave number and depend on the friction velocity. There are five wave number ranges of definition called the gravity wave-gravity equilibrium range, the isotropic turbulence range, the connecting range due to Leykin Rosenberg, the capillary range, and the viscous cutoff range. The higher wave number ranges are strongly wind speed dependent, and there is no equilibrium (or saturated) capillary range, at least for winds up to 30 meters/sec. Some properties of the angular variation of the spectra are also found. For high wave numbers, especially in the capillary range, the results are shown to be consistent with the Rayleigh-Rice backscattering theory (Bragg scattering),

and certain properties of the angular variation are deduced from backscatter measurements. Author

N74-15069# Joint Publications Research Service, Arlington, Va.
PROCESSING AND THEORETICAL ANALYSIS OF OCEANOGRAPHIC OBSERVATIONS
V. I. Belyayev 19 Dec. 1973 57 p Transl. into ENGLISH from the book "Obrabotka i Teoreticheskiy Anliz Okeanograficheskikh Nablyudeniy" Kiev, Naukova Dumka, 1973 45 p
(JPRS-60808) Avail: NTIS HC $5.00

Excerpts from a book are presented on processing and theoretical analysis of oceanographic and marine geologic-geophysical observation. A survey of oceanographic fields to compile charts for individual oceanic regions is planned. Author

N74-15070*# Scientific Translation Service, Santa Barbara, Calif.
OIL EXPLORATION SUBPROGRAM GEOLOGICAL INTERPRETATION OF IMAGES PROVIDED BY THE ERTS-A SATELLITE
C. Vargas F. Washington NASA Jan. 1974 10 p Transl. into ENGLISH of "Sub Program a Exploracion Petrolera, Interpretacion Geologica de Imagenes Proporcio Nadas por el Satelite ERTS-A", Servicio Geol. de Bolivia, Programa del Satelite Technol. de Resursos Nat., La Paz, report, 1973 9 p
(Contract NASw-2483)
(NASA-TT-F-15265) Avail: NTIS HC $3.00 CSCL 08G

Geological interpretation of three black and white images provided by the ERTS-A satellite is discussed. The study was to determine to what extent these images may be used to compile geological survey maps, using conventional photointerpretation techniques in the process. Author

N74-15071*# East Tennessee State Univ., Johnson City. Dept. of Geography.
SOME FOREST INTERPRETATION POTENTIALS OF HYPER-ALTITUDE PHOTOGRAPHY AND ERTS-A IMAGERY APPLICATIONS AND PROGNOSTICATIONS, TENNESSEE VALLEY TEST SITE Final Report
Richard E. Witmer Apr. 1972 23 p refs Sponsored by NASA and Geol. Survey
(NASA-CR-136591; PB-226216/AS; USGS-248; USGS-IR-NASA-248) Avail: NTIS HC $3.25 CSCL 06F

To test the potential of high altitude, color infrared photography and multispectral satellite imagery to provide forestry information to meet TVA needs, forest cover of an area in northern Alabama was mapped using 1:120,000-scale photography. Maps drawn from a mosaic and one drawn from the original transparency proved the increased accuracy of the map prepared from the transparency. Seven basic forest patterns were created by relating characteristic slopes, topographic positions, and drainage networks to the forest cover. The ability to produce a valid catalog of repeatable patterns that could be applied to specific case situations over a larger area was demonstrated. Author

N74-15072*# Scientific Translation Service, Santa Barbara, Calif.
TECTONIC PHYSICS SUBPROGRAM STRUCTURAL GEOLOGY OF BOLIVIA'S NORTHERN HIGH PLATEAU (SOUTHERN PERU AND NORTHERN CHILE)
C. Martinez Washington NASA Jan. 1974 11 p Transl. into ENGLISH of "Sub-Programa Tectonofisica Geologia Estructural del Altiplano Norte de Bolivia (Sur del Peru y norte de Chile)" La Paz, Servico Geologico di Bolivia, 1973 4 p
(Contract NASw-2483)
(NASA-TT-F-15263) Avail: NTIS HC $3.00 CSCL 08G

Data are based on two images from the ERTS-1 satellite. The purpose is to attempt a photogeological interpretation of these images. Author

N74-15073*# General Electric Co., Philadelphia, Pa. Space Div.
ERTS-1 FLIGHT EVALUATION REPORT, 23 APRIL - 23 JULY 1973
10 Aug. 1973 205 p refs
(Contract NAS5-21808)
(NASA-CR-136617; Doc-73SD4260) Avail: NTIS HC $12.25 CSCL 05B

The flight performance of the ERTS-1 satellite is analyzed for orbits 3810 to 5100. Systems analyzed include: orbital parameters, power subsystem, attitude control, telemetry, orbit adust, thermal control, and data collection. Documents and reports related to the evaluation are also included. F.O.S.

N74-15074*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OCEAN GEOID DETERMINATION INVESTIGATION
J. W. Siry, W. D. Kahn, J. W. Bryan, and F. O. Vonbun Jan. 1973 20 p refs
(NASA-TM-X-70551; X-590-73-250) Avail: NTIS HC $3.00 CSCL 08J

Proposals of investigation for the GEOS-C Ocean Geoid Determination mission are discussed for studying the mean sea level geopotential surface using the altimeter and the satellite-to-satellite tracking system. Factors affecting the interpretation of GEOS-C altimeter data for determining the MSL geometry are analyzed along with data processing. F.O.S.

N74-15075# World Meteorological Organization, Geneva (Switzerland).
JOINT IOC/WMO PLANNING GROUP FOR IGOSS
Oct. 1973 71 p 2nd Conf. held at Geneva, 13-17 Aug. 1973 Prepared jointly with UNESCO
Avail: NTIS HC $5.75; WMO, Geneva

Reports of progress on the Integrated Global Ocean Station System (IGOSS) are given together with a list of groups of experts and organizations interested in the program. Marine pollution monitoring aspects are discussed as well as specific operational programs such as collection, exchange, and evaluation of bathythermograph data; regionalization of IGOSS, and surface and near surface current observations. Further development and implementation of IGOSS, notably observational strategy including the use of coastal stations, and oceanographic services system are also discussed. Recommendations adopted at the session are included. ESRO

N74-15076# Weapons Research Establishment, Salisbury (Australia).
OBSERVATIONS OF TRAVELING IONOSPHERIC DISTURBANCES NEAR THE MAGNETIC DIP EQUATOR
R. F. Treharne Nov. 1972 15 p refs
(WRE-TN-A-226(AP)) Avail: AEC Depository Libraries $3.00

Ionospheric tilt observations made with the aid of a three-dimensional direction finder near the magnetic equator are described. Certain medium scale components of the tilts observed during the evening have characteristics which were identified with travelling ionospheric disturbances. TID properties such as direction and speed of travel, amplitude and wavelength are deduced from the observations which were made at a single observing site without using remote transmitters or receivers.
Author (NSA)

N74-15077# California Univ., Livermore. Lawrence Livermore Lab. Atmospheric Sciences Group.
[CIVIL AND MILITARY REQUIREMENTS FOR REGIONAL MODELING OF CHEMICAL OR RADIOACTIVE AIR POLLUTION] Program Report, FY 1973
28 Aug. 1973 22 p refs
(Contract W-7405-eng-48)
(UCRL-51444) Avail: NTIS HC $4.00

The research program in the atmospheric sciences at the Lawrence Livermore Laboratory is reviewed. The program is responsive to a number of national needs (outlined for both civil and military categories). Capabilities for regional modeling of air pollution by chemical or contamination by radioactive materials and the development of numerical models of particle transport and deposition are stressed. NSA

N74-15078# World Meteorological Organization, Geneva (Switzerland).
SNOW SURVEY FROM EARTH SATELLITES. A TECHNICAL REVIEW OF METHODS
1973 56 p refs Presented at the WMO/IHD meeting, Geneva, Mar. 1972
(WMO-353; Rept-19) Avail: NTIS HC $5.00; WMO, Geneva

Brief background information on satellite and sensor systems available for snow studies is provided, and methods used by various countries, as well as results obtained, are detailed. The methods used include direct opto-mechanical, opto-electronic, and automated electronic ones. Emphasis was placed on the use of satellite near-infrared and visual parts of the spectrum measurements for detection of thawing snow and ice surfaces. Recommendations for future action in the area of snow studies by satellites are made. Studies and techniques are proposed to fill existing gaps in knowledge and to take advantage of the data, data processing, or display equipment available. A simultaneous comparison of various methods over common test sites is proposed. ESRO

N74-15079# Stockholm Univ. (Sweden). Inst. of Meteorology.
PHOTOCHEMICAL REACTIONS INITIATED BY AND INFLUENCING OZONE IN THE TROPOSPHERE
Paul Crutzen May 1973 24 p refs
(AP-13) Avail: NTIS HC $3.25

Theoretical arguments in favor of OH concentrations larger than 1 million/cu cm in the sunlit lower troposphere, even if allowance is made for the possible heterogeneous removal of OH, HO2, and HNO3 molecules, are presented. The significant role played by OH in atmospheric C, N, and possibly S cycles is discussed. Low background mixing ratios of NO(x) molecules in the unpolluted atmosphere are predicted. The oxidation of NH3, initiated by reacting with OH, may provide an important source of tropospheric molecules. The conversion of NO2 into HNO3 is the most important trospospheric sink for NO(x) molecules. The photodissociation of ozone in ultraviolet light between 300 and 330 nm, which leads to the formation of the excited O(D7) atom, drives the entire sequence of reactions treated in this study. Several chains of reactions lead to formation and destruction of ozone. Author (ESRO)

N74-15080# Kiruna Geophysical Observatory (Sweden).
KIRUNA GEOPHYSICAL DATA. DATA SUMMARY 73/4-6, APRIL - JUNE 1973
G. Gustafsson, ed. Jun. 1973 65 p Prepared jointly with European Space Sounding Rocket Range
Avail: NTIS HC $5.25

Standard magnetograms recorded between April and June 1973 at Kiruna are reproduced. The K-indices derived from them are tabulated. Cosmic radio noise, averaged over the beam width of a vertical three-element Yagi antenna, was recorded with a riometer at 27,6 MHz. The ionospheric absorption was computed and the results are given. ESRO

N74-15081# International Business Machines Corp., Gaithersburg, Md. Federal Systems Div.
CARTOGRAPHIC AUTOMATIC MAPPING (CAM) PROGRAM DOCUMENTATION, VERSION 3
F. Frederic Stepler 6 Sep. 1973 147 p
(PB-223176/9GA; BGI-CD-74-1) Avail: NTIS HC 89.50 CSCL 06B

The CAM, an IBM systems 360, uses a FORTRAN program that performs a wide variety of cartographic tasks. It will connect points with straight lines or great circles and draw line grids, range rings, ellipses, cones, symbols, azimuths, and elevation rings. Sixteen basic map projections are included that can be used to plot from a contained World Coastline file of 8,200 points or from World Data Bank I of 100,000 points. GRA

N74-15082# Rockwell International Corp., Downey, Calif. Space Div.
COASTAL BATHYMETRIC PLOTTING Final Summary Report, 22 Feb. - 28 Sep. 1973
David T. Hodder 28 Sep. 1973 79 p refs
(Contract N00014-72-C-0149)
(AD-767721; SD-73-SA-0131) Avail: NTIS CSCL 08/10

The report summarizes the most recent research into the spatial temporal image merging technique for remote sensing of bathymetry in turbid coastal waters. Prior research had proved the method under average to optimum turbid water seeing conditions. This report discusses the degradation of the method under more severe environmental conditions and evaluates auxiliary methods for its improvement under difficult conditions. Factors such as sea state bottom reflectance variation and differing sediment loads are considered. Auxiliary methods for remote calibration include thermal IR scanning for surface current mapping, electronic removal of solar glitter patterns and spectral brightness variations in the sea, together with multiple color dye releases at their characteristic optical extinction depths to infer vertical current and hence sediment distribution. A final task is the preliminary evaluation of this bathymetry plotting method from ERTS-1 space imagery in a number of non-California, turbid coastal water types. (Modified author abstract) GRA

N74-15083# Ohio State Univ., Columbus. Dept. of Geodetic Science.
NUMERICAL RESULTS FROM THE COMBINATION OF GRAVIMETRIC AND SATELLITE DATA USING THE PRINCIPLES OF LEAST SQUARES COLLOCATION
Richard H. Rapp Mar. 1973 66 p refs
(Contract F19628-72-C-0120; AF Proj. 8607)
(AD-767313; DGS-200; AFCRL-TR-73-0195; SR-7) Avail: NTIS CSCL 08/5

The report develops working equations for carrying out the combination of gravimetric and satellite data starting from the equations of Moritz, and using the principles of the usual least squares adjustment and the least squares collocation. Of the two methods of combining data considered, one could not be carried out because of the need to invert a 1654 x 1654 full matrix. Numerical tests were conducted through the estimation of ten sets of potential coefficients complete to degree 20 plus certain resonance coefficients which have been derived starting from the GEM 3 potential coefficients and a 5 degree equal area block anomaly field. The solutions differ in two ways: first, the weighting applied to the a priori known potential coefficients, and second whether the usual least squares or collocation adjustment scheme is used for the estimation of the potential coefficients. To determine a best overall set of potential coefficients, comparisons have been made with astro-geodetic undulations (4196 values in Australia and the United States); with 5 degree anomalies; with anomaly degree variances, and by use of the coefficient sets in orbit fitting and prediction. Such comparisons indicate that collocation derived potential coefficients yield better values than those found using the usual least squares approach. A recommended set of potential coefficients and a consistent 5 degree equal area block anomaly field are given. Author (GRA)

N74-15084# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
SOME COMMENTS OF THE CHARGED PARTICLE TECHNIQUE FOR MEASURING ABSOLUTE GRAVITY Physical Sciences Research Papers
James A. Hammond 18 Jul. 1973 15 p refs
(AF Proj. 8607)
(AD-767592; AFCRL-TR-73-0425; AFCRL-PSRP-555) Avail: NTIS CSCL 08/5

Comments are made on several possible sources of systematic error inherent in the charged particle technique of measuring absolute gravity. It is shown that the effects of air flow and electric fields are potentially large enough that the difficulty of eliminating or measuring the effects forces the conclusion that the charged particle technique is not applicable in a practical sense to the measurement of absolute gravity at this time. Author (GRA)

N74-15085# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
ROCKET INVESTIGATIONS OF THE VLF IONOSPHERIC TRANSMISSION WINDOW Environmental Research Papers
Richard B. Harvey, Robert P. Harrison, Vollie C. Fields, George C. Hirst, and Paul A. Kossey 7 May 1973 34 p refs
(AF Proj. 4603)
(AD-767185; AFCRL-ERP-445; AFCRL-TR-73-0293) Avail: NTIS CSCL 04/1

Receivers were flown in rockets from Eglin Air Force Base, Florida, Natal, Brazil, and Fort Churchill, Canada, to study the fields of very low frequency (VLF) waves propagating in the earth-ionosphere waveguide, and leaking through the ionosphere to altitudes of 500-600 km. Amplitude-height, group delay,

and polarization profiles are given for signals from a number of ground based transmitters. A coherent propagation model is proposed and partially tested by calculating Doppler shifts. The model, extended with a full-wave computer program, allows wave-field profiles to be approximated theoretically. The extent to which some sample calculations agree with the observations is discussed. Author (GRA)

N74-15086# Regis Coll., Weston, Mass.
UPPER ATMOSPHERIC AND IONOSPHERIC DATA ANALYSIS FROM DATA RECORDED AT THULE AIR BASE, GREENLAND Final Report, 15 Apr. 1971 - 30 Jun. 1973
Leonarda Burke 30 Jun. 1973 30 p refs
(Contract F19628-71-C-0172; AF Proj. 7661)
(AD-768623; AFCRL-TR-73-0501) Avail: NTIS CSCL 04/1

Data from the AFCRL Geopole Observatory, Thule, Greenland were scaled from strip charts and placed on IBM cards for computer processing. Tables of the data processed are presented with examples of computer reduced graphic outputs.
Author (GRA)

N74-15087# Adaptronics, Inc., McLean, Va. 04/1
REFRACTIVE INDEX MEASUREMENTS BY ADAPTIVE TECHNIQUES (RIMDAPT), PHASE 1 Annual Report, 1 Sep. 1972 - 31 Aug. 1973
Florence W. VanStraten and Roger L. Barron Sep. 1973 63 p refs
(Contract N00014-73-C-0103)
(AD-769060; AR-1; NR Proj. 211-159) Avail: NTIS

The annual report presents results of a demonstration of the Adaptronics Method for atmospheric refractive index measurements via adaptive inference. It is shown that refractivity profiles computed by this method can provide significant improvement in ray trace accuracy. Author (GRA)

N74-15088# Florida Univ., Gainesville. Coastal and Oceanographic Engineering Lab.
INVESTIGATION OF THE VELOCITY FIELD OVER WAVES USING A WAVE FOLLOWER
O. H. Shemdin and R. J. Lai Jun. 1973 124 p refs
(Contract DACW72-71-C-0020; Grant NSF GK-31205)
(AD-769076; TR-18) Avail: NTIS CSCL 08/3

The turbulent velocity field over simple propagating waves is investigated by hot-film sensors in a wind and wave facility. Use is made of a wave follower to obtain measurements below the wave crest level. Turbulence measurements are obtained in a wave following frame over the range 1.75 - 25 cm above the instantaneous water level. The measurements are transformed to an Eulerian frame and compared to measurements obtained from fixed probes over a height range 10-50 cm above the mean water level. In the overlap region the transformed wave following results are in reasonable agreement with the fixed probes results. The measurements below the crest level indicate rapid variations in Reynolds stresses and wave induced velocities. The results suggest nonlinear wave induced perturbations close to the water surface and reveal weaknesses in assumptions adopted in recent theoretical models of turbulent shear flows over waves. Author (GRA)

N74-15240 Geological Survey, Washington, D.C.
GEOTHERMAL RESOURCES
L. J. P. Muffler *In its* US Mineral Resources 1973 p 251-261 refs (For availability see N74-15214 06-18)

N74-15343 Joint Publications Research Service, Arlington, Va.
POSSIBILITY OF MAPPING THE ICE SITUATION ON LARGE LAKES BY PHOTOGRAPHS FROM ARTIFICIAL EARTH SATELLITES
V. G. Prokacheva *In its* Meteorology and Hydrology no. 9, 1973 (JPRS-60787) 14 Dec. 1973 p 54-62 refs Transl. into ENGLISH from Meteorol. i Gidrol (Moscow), no. 9, 1973 p 48-55 (For availability see N74-15338 06-20)

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N74-15089* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ATTITUDE SENSOR Patent
Arthur L. Newcomb, Jr. and Aubrey G. Price, inventors (to NASA) Issued 25 Dec. 1973 4 p Filed 14 Sep. 1972 Supersedes N73-11406 (11 - 02, p 0174)
(NASA-Case-LAR-10586-1; US-Patent-3,780,966; US-Patent-Appl-SN-289049; US-Patent-Class-244-1SA; US-Patent-Class-102-70.2R; US-Patent-Class-244-3.16; US-Patent-Class-250-203R; US-Patent-Class-250-237R) Avail: US Patent Office CSCL 22B

A device for controlling the attitude of a spacecraft is described. The device consists of two light sensors on a spacecraft that are mounted beneath a baffle which divides the light from a light source such as the sun or a star. The divided light reflects off of two reflective surfaces onto the two light sensors. When the spacecraft assumes its normal attitude, the baffle divides the light source into two equal parts, causing the two light sensors to produce equal outputs. When the light is equally detected, the stabilizing system is disconnected. Deviations from the normal attitude cause unequal distribution of the light source and energize the stabilizing system. P.N.F.

N74-15090* National Aeronautics and Space Administration. Pasadena Office, Calif.
USE OF THIN FILM LIGHT DETECTOR Patent
George W. Lewicki, (JPL) and Joseph Maserjian, (JPL) Issued 25 Dec. 1973 10 p Filed 31 May 1972 Supersedes N72-28442 (10 - 19, p 2562) Continuation-in-part of abandoned US Patent Appl. SN-88435, filed 10 Nov. 1970 Sponsored by NASA
(NASA-Case-NPO-11432-2; US-Patent-3,781,549; US-Patent-Appl-SN-258152; US-Patent-Class-250-211J; US-Patent-Class-250-214; US-Patent-Class-317-235N; US-Patent-Appl-SN-88435) Avail: US Patent Office CSCL 14B

A photovoltaic cell device with a trapezoidal barrier is described. An aluminum, magnesium, or tantalum base is vapor deposited on a quartz substrate. An oxide or nitride film of the base metal is produced as an insulator by reaction in a glow discharge plasma to a thickness of less than 100 Angstroms. A metal, preferably gold, conter-electrode is vapor deposited on the insulating layer. A bias generator of high impedance is used to set and shift or modulate the spectral response of the device. Official Gazette of the U.S. Patent Office

N74-15091* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MOSSBAUER SPECTROMETER RADIATION DETECTOR Patent
Jag J. Singh, inventor (to NASA) Issued 25 Dec. 1973 4 p Filed 8 Dec. 1972 Supersedes N73-13433 (11 - 04, p 0421)
(NASA-Case-LAR-11155-1; US-Patent-3,781,562; US-Patent-Appl-SN-313381; US-Patent-Class-250-360; US-Patent-Class-250-361; US-Patent-Class-250-369; US-Patent-Class-250-492) Avail: US Patent Office CSCL 14B

A Mossbauer spectrometer with high efficiencies in both transmission and backscattering techniques is described. The device contains a sodium iodide crystal for detecting radiation caused by the Mossbauer effect, and two photomultipliers to collect the radiation detected by the crystal. When used in the transmission technique, the sample or scatterer is placed between the incident radiation source and the detector. When used in a backscattering technique, the detector is placed between the incident radiation source and the sample of scatterer such that the incident radiation will pass through a hole in the crystal and strike the sample. Diagrams of the instrument are provided. P.N.F.

N74-15092* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INSITU TRANSFER STANDARD FOR UTLRAHIGH VACUUM GAGE CALIBRATION Patent
Ronald A. Outlaw, Richard E. Stell, and Ronald F. Hoyt, inventors (to NASA) Issued 25 Dec. 1973 7 p Filed 14 Jul. 1972 Supersedes N72-28460 (10 - 19, p 2564)
(NASA-Case-LAR-10862-1; US-Patent-3,780,563; US-Patent-Appl-SN-271951; US-Patent-Class-73-4V) Avail: US Patent Office CSCL 14B

A compact insitu calibration assembly, for ultrahigh vacuum gauges is described. The system depends on the repeatable generation of a specific gas pressure by the dissociation of a solid solution chemical compound when subjected to a given temperature. A precise temperature measurement is related to the pressure generated within the vacuum by the properties of the solid solution compound. This accurately establishes the gas pressure which in turn is used to calibrate a vacuum gauge. Also included is a metering orifice used in the calibration system and which is made movable to facilitate the degassing bakeout required in ultrahigh vacuum devices.
Official Gazette of the U.S. Patent Office

N74-15093* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
HEATER-MIXER FOR STORED FLUIDS Patent
Thomas N. Canning, inventor (to NASA) Issued 1 Jan. 1974 4 p Filed 11 Aug. 1972 Supersedes N73-30415 (11 - 21, p 2547)
(NASA-Case-ARC-10442-1; US-Patent-3,782,698; US-Patent-Appl-SN-280032; US-Patent-Class-259-60; US-Patent-Class-62-45; US-Patent-Class-165-2; US-Patent-Class-165-109; US-Patent-Class-259-DIG.18) Avail: US Patent Office CSCL 14B

A fluid storage vessel for containing cryogenic fluids is described. The storage vessel contains an auxiliary chamber which is connected to the main container by a jet nozzle. The wall of the auxiliary vessel is heat cycled to produce a corresponding expansion and contraction of the fluid within the auxiliary chamber. This action causes heating and mixing of the stored fluid by means of jetting the expanded fluid to and from relative to the stored fluid contents of the vessel.
Official Gazette of the U.S. Patent Office

N74-15094* National Aeronautics and Space Administration. Pasadena Office, Calif.
TEMPERATURE COMPENSATED DIGITAL INERTIAL SENSOR Patent
Patrick J. Hand, (JPL) Issued 1 Jan. 1974 9 p Filed 9 Nov. 1972 Supersedes N73-13436 (11 - 04, p 0421) Sponsored by NASA
(NASA-Case-NPO-13044-1; US-Patent-3,782,205; US-Patent-Appl-SN-305012; US-Patent-Class-73-497; US-Patent-Class-73-517B; US-Patent-Class-74-5.6) Avail: US Patent Office CSCL 14B

A circuit which maintains the inertial element of a gyroscope or accelerometer at a constant position by delivering pulses to a rebalancing motor is discussed. The circuit compensates for temperature changes by using a temperature sensor that varies the threshold of inertial element movement required to generate a rebalance pulse which reacts to changes in viscosity of the flotation fluid. The output of the temperature sensor also varies the output level of the current source to compensate for changes in the strength of the magnets of the rebalancing motor. The sensor also provides a small signal to the rebalance motor to provide a temperature dependent compensation for fixed drift or fixed bias. Official Gazette of the U.S. Patent Office

N74-15095* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex
OPTICAL INSTRUMENTS Patent
Irving Raymond Abel, inventor (to NASA) (Honeywell, Inc., Minneapolis) Issued 1 Jan. 1974 6 p Filed 10 Apr. 1972 Supersedes N73-22388 (11 - 13, p 1529) Sponsored by NASA
(NASA-Case-MSC-14096-1; US-Patent-3,782,835; US-Patent-Appl-SN-242662; US-Patent-Class-356-216; US-Patent-Class-356-43; US-Patent-Class-350-7; US-Patent-Class-350-285; US-Patent-Class-350-236) Avail: US Patent Office CSCL 20F

A wide angle, low focal ratio, high resolution, catoptric, image plane scanner is described. The scanner includes the following features: (1) a reflective improvement on the Schmidt principle, (2) a polar line scanner in which all field elements are brought to and corrected on axis, and (3) a scanner arrangement in which the aperture stop of the system is imaged at the center of curvature of a spherical primary mirror. The system scans are a large radial angle and an extremely high rate of speed with relatively small scanning mirrors. Because the system is symmetrical about the optical axis, the obscuration is independent of the scan angle. Official Gazette of the U.S. Patent Office

N74-15096 Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
A NOTE ON PRESTON TUBE CALIBRATIONS IN COMPRESSIBLE FLOW
P. Bradshaw and K. Unsworth Sep. 1973 10 p refs
(Contract AT/2037/0133)
(IC-Aero-73-07)

The data of Allen for free stream Mach numbers between 2 and 4.6 are replotted in proper inner layer similarity form and fitted by an analytic expression which reduces to Patel's calibration at low Mach numbers. The form of the expression was chosen for ease of modification as further data become available. A computer program is listed. Author (ESRO)

N74-15097# Bureau of Mines, Bartlesville, Okla. Energy Research Center.
EVALUATION OF INSTRUMENTATION FOR MEASURING BEHAVIOR OF AEROSOLS IN SMOG CHAMBER STUDIES
H. B. Carroll, Jr. and R. M. Ray 1973 26 p refs Sponsored in part by EPA
(BM-RI-7818) Avail: NTIS HC $3.50

The adaptability of the nephelometer and the Sinclair-Phoenix smoke meter for use in routine, analytical, smog-chamber experiments is investigated and their response to aerosol during these experiments are compared. Both instruments' sampling systems were modified--smaller size sample input systems are studied using the nephelometer and a secondary sample system was added to the smoke meter to allow measurement of Aitken or condensate nuclei. Both instruments were easily adapted for use with small smog chambers and both displayed good precision and sensitivity to aerosol. A correlation was shown to exist between the two instruments' responses to aerosol. This correlation makes it possible to report the Sinclair-Phoenix measurements in visibility and/or mass units if desired. Author

N74-15098# Bureau of Mines, Bartlesville, Okla.
ACCURACY AND PRECISION OF SEVERAL PORTABLE GAS DETECTORS
H. B. Carroll, Jr. and F. E. Armstrong 1973 47 p refs
(BM-RI-7811) Avail: NTIS HC $4.50

The performance is evaluated of commercially available portable instrumentation for the detection of carbon monoxide, carbon dioxide, oxygen, and methane at conditions simulating an industrial work atmosphere. Portable instrumentation included in the study was gas-detection tubes (length-of-stain and color intensity), catalytic detector, liquid absorption detectors, paramagnetic oxygen detector, galvanic detector, and pelement or hot-wire methane detectors. Evaluation of the instruments was in atmospheres with 50 and 80 percent relative humidities at 75 F and containing test gas concentrations of 0.1 0.25, 0.50, 1.0, 1.5, and 2.0 times the threshold limit value. Correlation of the results from the portable gas analyzer with measurement from the standard instruments was made by calculating and plotting an estimated line of regression, prediction, and confidence limits and the correlation coefficient for each detector system. Relative humidity in the 50- to 80-percent range did not appear to contribute to instrumental uncertainties in either performance or operation. Author

N74-15099*# ITT Aerospace/Optical Div., Fort Wayne, Ind.
HIGH RESOLUTION INFRARED RADIATION SOUNDER FOR THE NIMBUS F SPACECRAFT Quarterly Report, Apr . - Jun. 1973

E. W. Koenig et al Sep. 1973 42 p ref Revised
(Contract NAS5-21651)
(NASA-CR-132899) Avail: NTIS HC $4.25 CSCL 14B

The HIRS engineering model has been completely assembled and bench tested. Vacuum chamber tests have been initiated and will be completed. Several design changes have been incorporated in the HIRS as a result of tests. These improvements relate to an increase in the reliability of operation of the scan mirror and data processing. Prototype component design is complete, with parts on order and in fabrication. A schedule of prototype activity is included. Author

N74-15100*# Rensselaer Polytechnic Inst., Troy, N.Y.
MASS SPECTROMETRY AND INHOMOGENEOUS ION OPTICS Final Report
Frederick A. White Washington NASA Nov. 1973 132 p refs
(Grant NGL-33-018-053)
(NASA-CR-2253) Avail: NTIS HC $4.50 CSCL 20F

Work done in several areas to advance the state of the art of magnetic mass spectrometers is described. The calculations and data necessary for the design of inhomogeneous field mass spectrometers, and the calculation of ion trajectories through such fields are presented. The development and testing of solid state ion detection devices providing the capability of counting single ions is discussed. New techniques in the preparation and operation of thermal-ionization ion sources are described. Data obtained on the concentrations of copper in rainfall and uranium in air samples using the improved thermal ionization techniques are presented. The design of a closed system static mass spectrometer for isotopic analyses is discussed. A summary of instrumental aspects of a four-stage mass spectrometer comprising two electrostatic and two 90 deg. magnetic lenses with a 122-cm radius used to study the interaction of ions with solids is presented. Author

N74-15101# Lockheed Missiles and Space Co., Palo Alto, Calif.
PHYSICAL CHARACTERISTICS OF THE COMPLEX OF SCIENTIFIC INSTRUMENTS RECORDING THE IONIZING COMPONENT OF COSMIC RAYS ON THE PROGNOZ
N. N. Volodichev, A. I. Vorobev, G. Ia. Kolesov, M. I. Kudriavtsev, O. B. Likin, V. N. Lutsenko, A. S. Melioranskii, E. I. Morozova, N. I. Nazarova, and N. S. Nikolaeva [1973] 9 p refs Transl. into ENGLISH from Geomagn. Aeron. (Moscow), v. 13, no. 4, 1973 p 590-598
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A method of investigating the characteristics of instruments intended to study the spectra of proton, alpha particles, atomic nuclei, electrons with 3 to 150 kev energies, and electromagnetic radiation in cosmic space on the Prognoz, is described. Author

N74-15102# Lockheed Missiles and Space Co., Palo Alto, Calif.
DETERMINATION OF THE CRITICAL CARBON DIOXIDE CONCENTRATION FOR SPOOL-VALVE MICROREFRIGERATORS
V. V. Balakov, R. K. Preobrzhenskii, and T. P. Andreeva [1973] 5 p refs Transl. into ENGLISH from Opt.-Mekh. Prom. (USSR), no. 10, 1973 p 9-12
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A method is described for determining critical carbon dioxide concentrations in the working gas of a microrefrigerator for infrared radiation detectors. Critical values are found for Linde type microrefrigerators. Author

N74-15103# National Aerospace Lab., Tokyo (Japan).
APPLICATION OF INTEGRATED CIRCUIT OPERATIONAL AMPLIFIERS TO TURBULENCE INTERMITTENCY METERS
Tadaharu Watanuki and Junzo Sato 1973 21 p refs In JAPANESE; ENGLISH summary
(NAL-TR-322) Avail: NTIS HC $3.25

An electrical device for measuring turbulence intermittency from hot-wire anemometer signals is made by applying integrated circuit operational amplifiers. Every detail of the circuit including differentiation, amplification, rectification, phase-shifting and discrimination is presented. The time constants of the circuit must be pre-determined from the hot-wire anemometer output. The settings of the phase-shifter and the discriminator are adjusted using the signals which are produced with low-frequency oscillators. The characteristics of the circuit are checked with the artificial turbulence having known intermittencies and known turbulence frequencies. The turbulence intermittencies within the transitional and the fully-turbulent boundary layers developed along the wall of the two-dimensional smoke wind-tunnel are measured as examples, and these compare favorably with the experimental data of others. Author

N74-15104# National Aerospace Lab., Tokyo (Japan).
ANALYSIS OF THE ANISOELASTIC ERRORS OF A FLOATED SINGLE DEGREE OF FREEDOM INTEGRATING GYRO
Masao Otsuki, Hirokimi Shingu, Jyoji Tabata, Takao Suzuki, and Shigeharu Enkyo Jun. 1973 12 p refs
(NAL-TR-188T) Avail: NTIS HC $3.00

A floated single-degree-of-freedom integrating gyro is used to sense angular rates of vehicle motion. It also senses the errors called drift rates by applying the acceleration whose direction is perpendicular to its output axis. The drift rate, which is proportional to the square of acceleration magnitude, is caused by a difference in compliance of the gimbal between the input axis and output axis, and is called anisoelastic error. The anisoelastic error was analyzed theoretically and experimentally through derivation of the theoretical formula, tumbling test, vibration experiment, and simulation. When vibrational accelerations were applied to the gyro, the anisoelastic error grew remarkably over a certain frequency range, because of a difference in natural resonant frequency depending on the anisoelasticity, and was the same as that caused by steady acceleration at the frequency without the influence of natural resonance. The experimental results of the anisoelastic error were closely proportional to the square of acceleration magnitude, and their frequency characteristics showed a tendency similar to the simulations. Author

N74-15105# Academia R. P. R., Bucharest. Inst. de Fizica Atomica.
INTERFACING OF THE MOESSBAUER SPECTROMETER ASA WITH THE ANALYZING SYSTEM NTA-512B
M. M. Sampaleanu and M. Morariu 1973 6 p
(IFA-SR-5-1973) Avail: AEC Depository Libraries $3.00

Interfacing and operation of the motor drive system and the data acquisition and processing system are briefly described. NSA

N74-15106# Dartmouth Coll., Hanover, N.H. Dept. of Physics and Astronomy.
NOISE THERMOMETER FOR TEMPERATURES FROM ABOVE 300K TO BELOW 4K
P. T. Anderson and P. B. Pipes 1972 15 p refs
(Contract AT(11-1)-2314)
(COO-2314-1) Avail: NTIS HC $3.00

The description of a solid-state noise thermometer is given and its use is discussed. Temperatures between 300K and 4.2K have been measured to better than 1% with a time constant of 5 seconds. Author (NSA)

N74-15107# Oak Ridge National Lab., Tenn. Civil Defense Research Section.
MEASUREMENT OF SHOCK OVERPRESSURE IN AIR BY A YIELDING FOIL MEMBRANE BLAST GAUGE
R. W. Manweiler, C. V. Chester, and C. H. Kearny Sep. 1973 30 p refs
(Contract W-7405-eng-26)
(ORNL-4868) Avail: NTIS HC $4.00

An inexpensive yet accurate pressure gauge was designed making use of the relationship between the peak pressure of a single-step rise shock loading and the permanent plastic deformation of thin foil membranes when subjected to shock loading. The gauge is of extremely simple design, is easy to use, and requires no electronic equipment. Peak shock overpressures from a few psi to hundreds of psi can be measured to about 10% accuracy. The relevant theory of shock loading of the thin foil membranes is presented, the calibration procedure using a shock tube is given, and the results of experimental

field tests are given and compared to standard shock overpressure measurements. Author (NSA)

N74-15108# Sandia Labs., Albuquerque, N.Mex. Exploratory Measurements Div.
ATMOSPHERIC SPEED-OF-SOUND MEASUREMENT DEVICE
L. K. Galbraith Aug. 1973 28 p refs Sponsored by AEC
(SLA-73-204) Avail: NTIS HC $4.00

A lightweight balloon-borne gauge was developed to measure atmospheric speed of sound at altitudes between 0 and 30 km. The advantages and disadvantages of various sound velocity measurement techniques are surveyed, and accuracy-limiting phenomena in the atmosphere and in the laboratory environment are discussed. In the gage design resulting from these studies, the sound velocity is determined from the phase difference between the signals from two sound receivers. These receivers are mounted at slightly different distances from a common transmitter emitting sound at a fixed frequency. The gage output is a pulse width modulated signal which is sent to a modified radiosonde transmitter. Accuracies of better than 1% in the field and 0.6% in climate chambers were demonstrated at ambient temperatures between +70 and -80 F. Inexpensive, readily available components are used in constructing the gage. Author (NSA)

N74-15109# National Physical Lab., Teddington (England). Div. of Quantum Metrology.
THE GYROMAGNETIC RATIO OF THE PROTON Progress Report
P. Vigoureux and N. Dupuy Aug. 1973 15 p refs
(NPL-QU-26) Avail: NTIS HC $3.00

The gyromagnetic ratio apparatus was used to monitor the ampere maintained at the National Physical Laboratory by means of standard resistors and Weston cells (NPL ampere). The results suggest that the unit decreased by 0.35 + or - 0.15 ppm (50% probability) during 1972. The thermal coefficient of the instrument was measured and found to be 0.41 ppm/k. Some improvements to the electronic circuits are described. Author (ESRO)

N74-15110# Rome Univ. (Italy). Inst. of Physics.
TRACKS DISCRIMINATION OF LOW ENERGY NUCLEI IN PLASTICS
G. Baroni, S. DiLiberto, S. Petrera, G. Romano, and C. Sgarbi 17 Apr. 1973 29 p refs
(Nota-Interna-458) Avail: NTIS HC $3.50

The efficiency of nitrocellulose plastic sheets as external detectors was studied as a function of impinging particle angle, energy loss rate, and other experimental conditions also in the presence of a high background of neutral and singly-charged particles. The discrimination among low energy nuclei with a two step method of analysis was achieved with the definition of a parameter (w), connected with the measured etched length of the tracks, that assures their almost certain assignment to the various nuclear species. Author (ESRO)

N74-15111# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
MACROFOCAL PARABOLAS FOR NIGHT PHOTOGRAPHY
John A. VanWorkum and Steven C. Parker Jun. 1973 47 p refs
(AF Proj. 7646)
(AD-767897; AFAL-TR-73-115) Avail: NTIS CSCL 14/5

Reflector contours called macrofocal parabolas are derived for use in aerial photography. These contours represent the most efficient reflector designs possible for a given aperture, field angle and finite sized light source. In addition, they give the smallest possible aperture which will reflect 100% of the emitted light into a given beam size. By reducing the efficiency, the reflector contours can be adjusted to tailor the radiant intensity distribution. Author (GRA)

N74-15112# Naval Ship Research and Development Center, Annapolis, Md.
FACTOR INFLUENCING ACCELEROMETER MEASUREMENT CAPABILITIES: A PRACTICAL MEASUREMENT GUIDE
R. W. Miller Sep. 1973 46 p refs
(AD-768298; NSRDC-3941; NSRDC-27-414) Avail: NTIS CSCL 14/2

After a brief review of the electromechanical functioning of the piezoelectric accelerometer, factors affecting its dynamic response characteristics and therefore the validity of vibration measurement are discussed. Consideration is given to variables such as shunt resistance and capacitance, mounting methods, base bending, cable noise, ground-loop currents, and environmental effects. Approved accelerometer mounting techniques that will ensure the accuracy and repeatability of the measurement are also described. Author (GRA)

N74-15113# Fairchild Space and Defense Systems, Syosset, N.Y.
KA-56 PANORAMIC CAMERA MODIFICATION Final Technical Report, Jun. 1972 - Mar. 1973
J. M. Daszkowski, E. J. ODonnell, and R. M. Sweet Aug. 1973 120 p
(Contract F30602-72-C-0374)
(AD-767908; SDS-ED-AC-39; RADC-TR-73-218) Avail: NTIS CSCL 14/5

The report describes a research and development project which is contributing considerably to the future metric use of a rotary prism, moving film panoramic camera. It contains a detailed description of the necessary modifications which are implemented on the KA-56 Panoramic Camera, and discusses the technical advancements which were made during the design, development, fabrication, and testing of the miniature state-of-the-art, solid state flash fiducial film marking system. (Modified author abstract) GRA

N74-15114# Defense Documentation Center, Alexandria, Va.
NON-DESTRUCTIVE TESTING: RADIOGRAPHY Report Bibliograpgy, Mar. 1964 - Jun. 1973
Nov. 1973 129 p refs
(AD-769100; DDC-TAS-73-66) Avail: NTIS CSCL 14/2

The bibliography is a compilation of unclassified-unlimited citations on Non-Destructive Testing: Radiography. References pertain to radiographic techniques for use in inspection and evaluation of electronic parts, metal fatigue, and filament wound materials. Author (GRA)

N74-15115# Instrument Flight Center, Randolph AFB, Tex.
EVALUATION OF THE MODIFIED BENDIX AAU 19A/A AIMS ALTIMETER Final Report
Manuel H. Tapia Aug. 1973 20 p
(IFC Proj. TE-73-4)
(AD-768722; IFC-TR-73-8) Avail: NTIS CSCL 01/4

The USAF Instrument Flight Center, Research and Development Division (IFC/RD), evaluated the modified Bendix AAU 19A/A AIMS altimeter from a pilot factors point of view. The emphasis was placed on hang and lope deficiencies noted during the original IFC evaluation of the Bendix AAU 19A/A altimeter (IFC TR-73-2). Three different types of aircraft were used for the evaluation -- a T-38 was used to investigate high performance capabilities of the altimeter while another altimeter was installed in a T-39 and a third in a T-29 to evaluate the altimeters' performance in a slower airspeed regime. Experienced instructor pilots from IFC/RD and several Instrument Pilot Instructor School (IPIS) student pilots evaluated the altimeter during 45 missions totaling approximately 60 hours of flying time. (Modified author abstract) GRA

N74-15616 Technische Hochschule, Aachen (West Germany). Inst. fuer Leichtbau.
HOMOLOGOUS DEFORMATION OF STIFFENED SHELLS FOR RADIO TELESCOPE STRUCTURES
J. F. Kowalewski and H. A. Ziebarth *In* AGARD Second Symp. on Structural Optimization Nov. 1973 13 p refs (For availability see N74-15596 06-32)

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection.

N74-15116 British Library Lending Div., Boston Spa (England).

METAL AND WELDING IN THE THERMAL POWER INDUSTRY OF JAPAN

A. Z. Kontorovskii 5 Jul. 1973 11 p Transl. into ENGLISH from Teploenerg. (Moscow), v. 13, no. 4, 1966 p 85-87 (CE-Trans-5704) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

Metal welding techniques in Japan's thermal power industry are examined. Special attention was given to manual argon arc welding. E.H.W.

N74-15117 British Library Lending Div., Boston Spa (England)

HOT WORKING OF LEAD-CONTAINING ALPHA-BETA BRASSES

B. Fischer Jul. 1973 12 p refs Transl. into ENGLISH from Neue Huette (East Germany), v. 17, 1972 p 530-534 In ENGLISH and GERMAN (BLL-LTI-746-1445-(9022.401)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

Low melting point materials in brass can lead through their melting at the working temperature to cracking. Because of this fact, the lead content often present in brass is frequently regarded as being responsible for the difficulties in hot working. Tests were conducted to determine the validity of this view and to resolve the question of the effect of various other factors. The test results indicated that the difficulties are not brought about by fluctuating contents of lead, impurities, trace elements, or slag inclusions nor through an unsatisfactory microstructure in the initial state. Instead, the cracking is brought about by the fact that the relationship between the copper content and the optimal working temperature are not taken into account, and the temperatures established are not maintained with the necessary accuracy. D.L.G.

N74-15118 British Library Lending Div., Boston Spa (England)

ACTIVATION OF THIN CHROMIUM FILMS IN THE ELECTRO-PLATING OF NONCONDUCTORS

A. F. Bogenschuetz, L. Jostan, and D. Roeschenthaler 5 Jul. 1973 19 p Transl. into ENGLISH from Galvanotechnik (West Germany), v. 63 no. 11, 1972 p 996-1003 In ENGLISH and GERMAN (BLL-LTI-746-1459-(9022.401)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

Direct reinforcement by electroplating of adherent Cr films requires previous activation because of the passivity of the chromium. Following tests on various known electrochemical and chemical activation processes, which did not completely fulfill the requirements, an efficient activation solution in a bromate pickle was found. This method makes possible an adherent, solderable, electrolytic reinforcement of thin chromium films vapor-deposited on ceramic substrates, such as are employed in the manufacture of strip-line or other thin film circuits. The studies on these processes for metallizing nonconductors are supplemented by adhesion and quality measurements. Furthermore, the passivation and depassivation processes on the chromium surface are discussed. Author

N74-15119 British Library Lending Div., Boston Spa England

ON THE MECHANISM OF SOUND GENERATION DURING CUTTING. 2: INVESTIGATIONS OF THE IDLING NOISE

J. Troeger 5 Jul. 1973 13 p refs Transl. into ENGLISH from Holzforschung (Berlin), v. 10, no. 4, 1969 p 254-269 (BLL-Lib-Com-1743-(5196)) Avail: British Library lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

The acoustic properties of wood working machines were investigated for various conditions of operation. The noise is characterized as eddy noise, siren noise, or noise due to characteristic vibrations of the tool. The noise produced by the interaction of the rotating tool with the air and its immediate surroundings is emphasized. A numerical analysis of the noise abatement potential based on eddy and siren noise is developed. Author

N74-15120 British Library Lending Div., Boston Spa (England).

THE CRITICAL THICKNESS ON THE LUBRICATING FILM IN THE SHAPING OF METALS BY PRESSURE

A. D. Tomlenov 4 Jul. 1973 7 p refs Transl. into ENGLISH from Kuznechno-Shtampovochnoe Proizvod. (USSR), no. 3, 1972 p 3-5 In ENGLISH and RUSSIAN (BLL-NEL-TT-2481-(6075.461)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

Problems relating to the evaluation of lubrication efficiency are discussed. The principle difficulty relates to stresses in conjugation with velocities. This difficulty was eliminated by introducting into the calculation a factor representing the critical thickness of the lubricating layer at which plastic flow of the blank commences. In these calculations the thickness is equated to that of uniformly distributed thickness of a layer of equivalent load carrying capacity. Author

N74-15121 British Library Lending Div., Boston Spa (England).

INCREASING THE STRENGTH OF CARBURIZED AND CARBONITRIDED GEAR TEETH

I. Ya. Arkhipov at al 3 Sep. 1973 13 p refs Transl. into ENGLISH from Metalloved. Term. Obrab. Metal. (USSR), no. 10, 1970 p 56-61 In ENGLISH and RUSSIAN (BLL-NEL-TT-2493-(6075.461)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

Spur gears were studied in an effort to determine in effects of internal oxidation on the design fatigue strength of carburized and carbonitrided steel. The gears were heat treated in a controlled automatic carbon potential regulated atmosphere in muffleless units and tested on a test bed with center distance 150 mm at a pitch line velocity of 15 m/sec. Results show that gear fatigue strength depends on surface microhardness in the tool fillet. Data also show that allowances should be made for internal oxidation susceptibility of alloying elements and the formation of carbonitrides during gear tests. Author

N74-15122 British Library Lending Div., Boston Spa (England).

INCREASING THE WEAR RESISTANCE OF COMPONENTS BY PLASMA SPUTTERING

G. F. Degtev, B. M. Solovev, F. F. Vashkevich, and V. I. Zhuravel Feb. 1973 7 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Mashinostro. (Moscow), v. 3, 1972 p 127-131 (BLL-RTS-7940) Avail: British Library Lending Div., Boston Spa, Engl.: £0.60 or 2 BLL photocopy coupons

The results of tests to determine the feasibility of using plasma sputtered coatings to protect the cases of screw conveyors from attrition by abrasive materials are presented. Comparisons were made, under laboratory conditions, of the wear resistance of coatings derived from various powder mixes, deposited by plasma torches. A technique for coating the case of K-167 screw conveyor was perfected. Industrial trials of cases for K-167 screw conveyors coated by these methods are undertaken and the results indicate that a high degree of wear resistance was obtained. Author

N74-15123 British Library Lending Div., Boston Spa (England).

EVAPORATION OF CHROMIUM FROM NICKEL BASED ALLOYS

V. A. Grigoryan, R. A. Aleev, and M. I. Pryanishnikov [1973] 6 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Chernaya Met. (Moscow), v. 5, 1973 p 10-12 (BLL-M-21770-(5828.4F)) Avail: British Library Lenging Div., Boston Spa, Engl.: 1 BLL photocopy coupon

An evaporation method on a vacuum open surface was used to study evaporation kinetics of chromium from a binary Cr-Ni alloy at 1600 C. In circumstances where the convection stirring

of the alloy was reduced to a minimum, the evaporation phenomena are limited to the diffusion mobility of the chromium atoms in the body of the metal. This is confirmed by the linear relationship of the chromium quantity entering the gas phase and the experimental time root. A coefficient of chromium diffusion in Ni-Cr alloys at 1600 C is proposed based on the theory of atom transfer in the evaporating component in an alloy/vacuum system. Author

N74-15124 Pittsburgh Univ., Pa.
THERMOHYDRODYNAMIC LUBRICATION IN LAMINAR AND TURBULENT REGIMES Ph.D. Thesis
Zeinab Saleh Safar 1973 113 p
Avail: Univ. Microfilms Order No. 73-24099

A thermohydrodynamic analysis is extended to include turbulent flow bearings. The distribution of effective viscosity, assumed dependent on local shear and temperature, is obtained via iteration between the long bearing momentum and energy equations. The shaft is treated as an isothermal component and the bearing is assumed to conduct heat only in the radial direction. The bearing is replaced by an equivalent boundary condition of the energy equation, which becomes amenable to solution by the Galerkin-Kantarovich method. Numerical results show the mathematical model to be sensitive to the values of eccentricity ratio, Reynolds number, Nusselt number of the lubricant, and the shaft temperature. Sample calculations are performed with two distinct shaft temperatures which are: equal to the oil inlet temperature and to the bearing inner surface respectively. The calculations also indicate significant thermal effects in bearing performance in both laminar and turbulent regimes.

Dissert. Abstr.

N74-15125* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SPIRAL GROOVE SEAL Patent
Lawrence P. Ludwig and Thomas N. Strom, Inventors (to NASA) Issued 1 Jan. 1974 6 p Filed 24 Jan. 1972 Supersedes N72-27522 (10-18, p 2439) Continutation-in-part of US Patent Appl. SN-54540, filed 13 Jul. 1970, which is a continuation-in-part of abandoned US Patent Appl. SN-723465, filed 23 Apr. 1968
(NASA-Case-XLE-10326-4; US-Patent-3,782,737;
US-Patent-Appl-SN-220251; US-Patent-Class-277-27;
US-Patent-Class-277-91; US-Patent-Appl-SN-54540;
US-Patent-Appl-SN-723465) Avail: US Patent Office CSCL 11A

Mating flat surfaces inhibit leakage of a fluid around a stationary shaft. A spiral groove produces a pumping action toward the fluid when the shaft rotates. This prevents leakage while a generated hydraulic lifting force separates the mating surfaces to minimize wear. Provision is made for placing these spiral grooves in communication with the fluid to accelerate the generation of the hydraulic lifting force.

Official Gazette of the U.S. Patent Office

N74-15126* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
BIMETALLIC FLUID DISPLACEMENT APPARATUS Patent
Thomas N. Canning, inventor (to NASA) Issued 1 Jan. 1974 5 p Filed 11 Aug. 1972 Supersedes N73-30461 (11 - 21, p 2552)
(NASA-Case-ARC-10441-1; US-Patent-3,782,699;
US-Patent-Appl-SN-280029; US-Patent-Class-259-98;
US-Patent-Class-417-471; US-Patent-Class-417-470) Avail: US Patent Office CSCL 13K

Stirring and heating stored gases and liquids is accomplished by using the deformation of a bimetallic structure which deforms significantly when heated. The deformation is used to effect gradual or impulsive motion of a piston, vane, wire, or diaphram for displacement of the fluid. The heated bimetallic is also employed for heating the stored fluid.

Official Gazette of the U.S. Patent Office

N74-15127* National Aeronautics and Space Administration. Pasadena Office, Calif.
COMPACT HYDROGENATOR Patent
Peter G. Simmonds, inventor (to NASA) (JPL) Issued 1 Jan. 1974 7 p Filed 7 Oct. 1971 Supersedes N72-21474(10 - 12, p 1617) Sponsored by NASA
(NASA-Case-NPO-11682-1; US-Patent-3,782,904;
US-Patent-Appl-SN-187365; US-Patent-Class-23-284) Avail: US Patent Office CSCL 13I

The development and characteristics of a hydrogenating apparatus are described. The device consists of a reaction chamber which is selectively permeable to atomic hydrogen and catalytically active to a hydrogenating reaction. In one device, hydrogen is pumped out of the reaction chamber while the reactant remains inside to remove molecular hydrogen so that more atomic hydrogen can pass through the walls. In another device, the reactant is pumped through the reaction chamber, and the hydrogen is removed from the material leaving the chamber. The reactant is then cycled through the chamber.

Official Gazette of the U.S. Patent Office

N74-15128* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METHOD OF MAKING ROLLING ELEMENT BEARINGS Patent
Richard J. Parker, inventor (to NASA) Issued 1 Jan. 1974 4 p Filed 14 Aug. 1972 Supersedes N72-31491 (10 - 22, p 2971) Continuation-in-part of US Patent Appl. SN-201904, filed 24 Nov. 1971
(NASA-Case-LEW-11087-2; US-Patent-3,781,958;
US-Patent-Appl-SN-280390; US-Patent-Class-29-148.4A;
US-Patent-Class-29-148.4B; US-Patent-Appl-SN-201904) Avail: US Patent Office CSCL 13I

A method is described of making rolling elements by forming low mass cores having either hollow centers or being of a low mass material. The low mass cores are plated and heat treated to provide hard surfaces on the rolling elements. After grinding to the proper diameter the rolling elements are assembled between races to form a hearing.

Official Gazette of the U.S. Patent Office

N74-15129 Carnegie-Mellon Univ., Pittsburgh, Pa.
A SYNTHESIS PROCEDURE FOR MECHANICALLY FASTENED JOINTS IN ADVANCED COMPOSITE MATERIALS Ph.D. Thesis
John Paul Waszczak 1973 194 p
Avail: Univ. Microfilms Order No. 73-22886

An automated preliminary design capability is provided for weight minimized mechanically fastened joints and common characteristics of such minimized weight designs are identified. The problem of a single column of fasteners loaded in simple tension is considered. The main plate can be made of either graphite-epoxy or boron-epoxy and is loaded by double shear metal splice plates. Independent linear variations in plate widths and thicknesses, including individual ply orientation thicknesses, are permissible along the length of the joint. An optimization algorithm based on the variable metric method is used to solve the unconstrained minimization problem which is formulated using an interior penalty function. The first failure analysis, based on the maximum ply stress failure criterion, used in conjunction with a simple joint modeling procedure and bolt load partitioning analysis is shown capable of conservatively predicting the failure characteristics of several multiple fastener joints. Dissert. Abstr.

N74-15130* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ULTRASONIC SCANNING SYSTEM FOR IN-PLACE INSPECTION OF BRAZED TUBE JOINTS Patent
Johnny L. Haynes, Charles G. Wages, and Hamilton S. Haralson, inventors (to NASA) Issued 11 Dec. 1973 6 p Filed 9 Nov. 1971 Supersedes N72-21482 (10 - 12, p 1618)
(NASA-Case-MFS-20767-1; US-Patent-3,777,552;
US-Patent-Appl-SN-196898; US-Patent-Class-73-67.8S) Avail: US Patent Office CSCL 14D

A miniaturized ultrasonic scanning system for nondestructive in-place, non-immersion testing of brazed joints in stainless-steel tubing is described. The system is capable of scanning brazed tube joints, with limited clearance access, in 1/4 through 5/8 inch union, tee, elbow and cross configurations. The system has the capability to detect defective conditions now associated with material density changes in addition to those which are depended upon density variations. The system includes a miniaturized scanning head assembly that fits around a tube joint and rotates

the transducer around and down the joint in a continuous spiral motion. The C-scan recorder is similar in principle to conventional models except that it was specially designed to track the continuous spiral scan of the tube joint. The scanner and recorder can be operated with most commercially available ultrasonic flaw detectors. Official Gazette of the U.S. Patent Office

N74-15131+ Lyon Univ. (France). Lab. de Technologie des Surfaces.
CRITICAL BIBLIOGRAPHIC ANALYSIS OF LIMIT LUBRICATION. LIQUID-SOLID MOLECULAR INTERACTION INFLUENCE ON LIMIT FILM PROPERTIES Final Report [ANALYSE BIBLIOGRAPHIQUE CRITIQUE DE LA LUBRIFICATION LIMITE. INFLUENCE DES INTERACTIONS MOLECULAIRES ENTRE LIQUIDES ET SOLIDES SUR LES PROPRIETES DES FILMS LIMITES COMPTE-RENDU DE FIN DE CONTRAT]
J. M. Georges, J. Chappuis, M. Jacquet, M. Combe, and S. Bourasseau Nov. 1972 85 p refs In FRENCH
(Contract DGRST-71-7-2634)
Avail: NTIS HC $6.25

A bibliography on the fundamentals of lubrication is presented, noting tribological, mechanical, and physico-chemical aspects. Topics include: choice of contact; choice of way of deposition of the lubricant; friction coefficient; film stability; adsorption; friction and chemical affinity correlation; difference in reactivity of a metal and its oxide with a fatty acid; and environmental influence on lubrication qualities of a fatty acid film. Oxygen and water vapor play an important role in lubrication limit. It is easier to lubricate a metal covered by an oxide layer than a non-oxidized metal surface. Methods for measurements on thin films, including film thickness, film structure, moistening and electrical measurements, are discussed in detail. ERSO

N74-15132# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
ANALYSIS OF SHORT JOURNAL BEARINGS WITH NEW BOUNDARY CONDITIONS
I. Etsion and O. Pinkus Sep. 1972 35 p refs
(TAE-161) Avail: NTIS HC $3.75

The Reynolds equation, for short journal bearing, is treated with a new approach to the boundary condition at the beginning of the lubricating film. The nondimensional hydrodynamic side leakage and other performance characteristics of the bearing are shown to be a function not only of Sommerfeld number and width over diameter ratio but also of another parameter which depends on the starting condition at the film inlet. The results obtained by other investigators till now are shown to be only a limiting case of the more general analysis given here. Author

N74-15133# National Aeronautical Lab., Bangalore (India).
RELATIONSHIP BETWEEN THERMOVOLTAGE AND SINTERING PROCESS
G. Ritzau Nov. 1973 14 p refs Transl. into ENGLISH from Sonderdruck aus den Planseeberichten, v. 8, no. 3
(NAL-TR-190) Avail: NTIS HC $3.00

The use of the thermovoltage method to visually observe all changes in phase transformations from powder mixture to finished compact body under sintering is reported. E.H.W.

N74-15134*# Kanner (Leo) Associates, Redwood City, Calif.
A ROBOT ON THE LADDER OF EVOLUTION
M. Vasin Washington 2pub NASA Jan. 1974 24 p Transl. into ENGLISH from Nauka i Zhizn (Moscow), no. 11, Nov. 1973 p 16-25
(Contract NASw-2481)
(NASA-TT-F-15278) Avail: NTIS HC $3.25 CSCL 05H

Two robots are described: a six-legged walking spider and a four-eyed manipulator arm. At this stage of development, the robot-manipulators are being assembled from parts already produced by industry but used in aviation technology. The spider can travel across almost any terrain by varying its gait and posture; the fastest gait is three legs at a time (6 km/hr). It can even stand on tiptoe or crouch and, with special attachments, can travel along precipices and slopes. Its laser eyes can see for 10-15 m and simultaneously measure distances with an accuracy of 5 mm. The other, simpler, robot is a manipulator arm with four photocell eyes and a working surface with tactile sensors which, in addition to sensing the object, also determines the angles at which the various elements of the hand are located and the effort required by the hydraulic muscles. Author

N74-15135# Bureau of Mines, Boulder City, Nev. Metallurgy Research Lab.
CLEANING TITANIUM ALLOY CHIPS
O. Q. Leone 1973 21 p refs
(BM-RI-7711) Avail: NTIS HC $3.25

A processing unit was developed for the complete cleaning of titanium alloy chips. The process uses solvent degreasing, magnetic separation, and anodic solution of nonmagnetic impurities in 10 weight-percent sulfuric acid. Vacuum arc-melted ingots weighing approximately 10 pounds each were prepared from cleaning chips according to ingot specifications. Author

N74-15136*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
BALL MOTION AND SLIDING FRICTION IN AN ARCHED OUTER-RACE BALL BEARING
Bernard J. Hamrock Washington Jan. 1974 46 p refs
(NASA-TN-D-7448; E-7607) Avail: NTIS HC $3.00 CSCL 13I

The motion of the ball and sliding friction in an arched outer-race ball bearing under thrust load is analyzed. Fatigue life evaluations were made. The analysis is applied to a 150-millimeter-bore ball bearing. The results indicated that for high-speed light-load applications the arched bearing has significant improvement in fatigue life over that of a conventional bearing. An arching of 0.254 mm (0.01 in.) was found to be optimal. Also, for an arched bearing a considerable amount of spinning occurs at the outer-race contacts. Author

N74-15137# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RADIO ENGINEERING METHOD FOR DETERMINING THE DEGREE OF WEAR OF MACHINE PARTS
V. S. Vergunov, O. G. Korol, T. I. Lyasjenko, L. A. Skalko, and V. S. Chumachenko 19 Sep. 1973 10 p refs Transl. into ENGLISH from Samoletostr. Tekh. Vozdush. Flota (USSR), no. 25, 1971 p 69-71
(AD-768059; FTD-HT-23-181-74) Avail: NTIS CSCL 14/2

A method is proposed for the analysis of oil to determine the content of iron in it. It is based on a change in the quality factor of an induction coil, into which a test tube with the investigated oil has been placed. GRA

N74-15138# Lear Motors Corp., Reno, Nev.
VAPOR GENERATOR FEED PUMP FOR RANKINE CYCLE AUTOMOTIVE PROPULSION SYSTEM Final Report
Max K. Winkler Dec. 1972 72 p refs
(Contract EPA-68-01-0437)
(PB-222871/6; APTD-1358) Avail: NTIS HC $3.50 CSCL 13K

Results are presented on preliminary design studies conducted to define feed pumps that satisfy the performance requirements for the following Rankine cycle automotive power systems: (1) steam engine systems; (2) aerojet liquid rocket company; and (3) thermo electron corporation. The approach consisted of establishing feed pump requirements for the three applications. Investigations revealed that the feed pump developed by Lear Motors Corporation satisfies the basic requirements of the three system contractors. A description of the Lear feed pump and its operating principle is presented. A summary of the flow requirements and estimated brake horsepower for the 3 system contractor feed pumps is shown graphically. GRA

N74-15139# Naval Ordnance Station, Louisville, Ky.
THE DEVELOPMENT OF RATIONAL TECHNIQUES FOR THE UTILIZATION OF ELECTROCHEMICAL MACHINING Final Report
J. F. Thorpe, R. D. Zerkle, and F. Fluerenbrock Jul. 1973 261 p refs
(AD-767324; NOSL-M1-019) Avail: NTIS CSCL 13/8

Some sixty-two machining tests were conducted with the test device in a production ECM machine, the results of which were numerically analyzed and compared with the theoretical

equations. The theory was modified and computer programs written to analyze the mathematical formulation; test computations were performed to verify their accuracy. A computer program has been written so that the rectilinear equilibrium gap can be predicted. (Modified author abstract) GRA

N74-15140# Auburn Univ., Ala.
STUDY OF THE ONSET OF PERMANENT DEFORMATION IN STRUCTURALLY BONDED JOINTS Final Report, 19 Nov. 1971 - 19 Apr. 1973
Wartan A. Jemian and Roy C. Wilcox Aug. 1973 75 p refs
(Contract DAAH01-72-C-0358)
(AD-768689) Avail: NTIS CSCL 13/5

Adhesive bonding is a standard production method in aircraft construction. The elastic sample compliance vs. crack length curve for adhesive bonded samples in the lap-shear configuration was found to have a positive curvature and an increasing slope with increasing crack length. The effects of various sample parameters on the compliance variation curve were determined. Sample compliance is a linear function of adhesive thickness and the sample stiffness depends directly upon overlap length, adherend thickness, adhesive and adherend moduli, and sample width. This research was conducted by experimentation and finite element computation. The materials were EPON 828/D, EPON 901/B-1, and EPON 901/B-3 adhesives and aluminum alloy 2024-T4 and alclad alloy 2024-T3 adherends. Fracture surfaces were studied by direct observation and by scanning electron and replica electron microscopy. Features of plastic flow, slow and rapid crack extension were oxserved. A standard procedure for fracture toughness testing with samples in the lap-shear configuration was outlined. (Modified author abstract) GRA

N74-15141# British Steel Corp., London (England).
BIBLIOGRAPHY OF ELECTRICAL INTERFERENCE IN INSTRUMENT AND CONTROL ENGINEERING
A. M. Healey Aug. 1973 66 p refs
(PB-223732/9GA; BISRA-INF/1/73) Avail: NTIS HC $3.50 CSCL 13H

The bibliography contains 297 selected references on various aspects of electrical interference, which are relevant to instrumentation and control engineering in the process industries. The fields of radio and communications engineering are excluded. GRA

N74-15142# Boeing Vertol Co., Philadelphia, Pa.
DESIGN, FABRICATION, TEST, AND EVALUATION OF SPIRAL BEVEL SUPPORT BEARINGS TAPERED ROLLER Final Report, 4 Mar. 1971 - 4 Dec. 1972
A. J. Lemanski, J. W. Lenski, Jr., and R. J. Drago Jun. 1973 188 p refs
(Contract DAAJ02-71-C-0025; DA Proj. 1G1-62207-AA-74)
(AD-769064; USAAMRDC-TR-73-16) Avail: NTIS CSCL 13/9

The report presents the results of an analytical and experimental program to evaluate the influence of critical bearing parameters on the performance of high-speed (20,000 fpm - 1.42 million DN), high-load (5500-lb thrust, 7500-lb radial) tapered-roller, spiral bevel gear support bearings for use in helicopter transmissions. The program consisted of a generalized analytical investigation and then an experimental investigation based on the information obtained in the analytical investigation. In the generalized analytical investigation, a method of analysis was developed which covered bearing kinematics, internal load distribution, oil film thickness, contact stress, and fatigue life. The experimental investigation was conducted on 53 tapered roller bearings of the 6500 series (3.50-in. bore) by performing rotating load testing. Also, preliminary screening tests were conducted on 13 additional bearings to establish key bearing design modifications.
Author (GRA)

N74-15143# AiResearch Mfg. Co., Phoenix, Ariz.
COMPLAINT FOIL GAS LUBRICATED BEARING Final Report, Apr. 1972 - May 1973
D. E. Heuer and R. A. Collins Jun. 1973 95 p
(Contract F33615-72-C-1802)
(AD-768454; AIRESEARCH-73-310169; AFAPL-TR-73-56) Avail: NTIS CSCL 13/9

A series of demonstration tests, similar to those required for engine qualification, were conducted on a gas turbine engine using gas lubricated complaint foil bearings. The engine operated successfully throughout the water ingestion and dust ingestion tests. When subjected to high-yaw manuever rates, which subjected the bearings to high gyroscopic moment loads, the ultimate load capacity of the bearings was reached. When subjected to high vibration, structural resonance was incurred which amplified the input vibration at the bearing carrier. The forward journal bearing did not survive the test but its vibrational loading was 5 times what was originally intended. Results of the overtemperature test indicated that the present bearing coating is acceptable up to 550F, but higher temperature coatings would be required if the bearings should be installed in new, advanced-design engines. (Modified author abstract) GRA

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid-State.

N74-15144 British Library Lending Div., Boston Spa (England).
ELECTRON BEAM HOLOGRAPHY
H. Watanabe and A. Tonomura Aug. 1973 9 p refs Transl. into ENGLISH from Nippon Kessho Gakkaishi (Tokyo), v. 23, no. 11, 1969 p 23-25
(BLL-RTS-7874) Avail: British Library Lending Div., Boston Spa, Engl.: £0.80 or 3 BLL photocopy coupons

Progress is discussed in imagery from electron beam holograms using laser beams. The advantages of electron beam holography are considered to be the resolution, and image constrast. F.O.S.

N74-15145* National Aeronautics and Space Administration. Pasadena Office, Calif.
SHORT RANGE LASER OBSTACLE DETECTOR Patent
William L. Kuriger, inventor (to NASA) (JPL) Issued 25 Dec. 1973 8 p Filed 16 Mar. 1972 Supersedes N72-25490 (10 - 16, p 2164) Sponsored by NASA
(NASA-Case-NPO-11856-1; US-Patent-3,781,111; US-Patent-Appl-SN-235268; US-Patent-Class-356-5; US-Patent-Class-356-4; US-Patent-Class-356-152; US-Patent-Class-250-217SS; US-Patent-Class-350-6; US-Patent-Class-331-94.5K; US-Patent-Class-331-94.5S) Avail: US Patent Office CSCL 20E

A short range obstacle detector for surface vehicles is described which utilizes an array of laser diodes. The diodes operate one at a time, with one diode for each adjacent azimuth sector. A vibrating mirror a short distance above the surface provides continuous scanning in elevation for all azimuth sectors. A diode laser is synchronized with the vibrating mirror to enable one diode laser to be fired, by pulses from a clock pulse source, a number of times during each elevation scan cycle. The time for a given pulse of light to be reflected from an obstacle and received is detected as a measure of range to the obstacle.
Official Gazette of the U.S. Patent Office

N74-15146* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
METHOD AND APPARATUS FOR CHECKING THE STABILITY OF A SETUP FOR MAKING REFLECTION TYPE HOLOGRAMS Patent
Helmut G. Lackner, inventor (to NASA) Issued 1 Jan. 1974 5 p Filed 18 Aug. 1972 Supersedes N72-31515 (10 - 22, p 2974)
(NASA-Case-MFS-21455-1; US-Patent-3,782,825; US-Patent-Appl-SN-281877; US-Patent-Class-356-106; US-Patent-Class-350-3.5; US-Patent-Class-73-71.3) Avail: US Patent Office CSCL 20E

A method and apparatus are described for checking the stability of a setup for recording reflection-type (white light) holograms. Two sets of interference fringes are simultaneously obtained, one giving information about coherence and stability of the setup alone and the other demonstrating coherence of the entire system, including the holographic recording plate. Special emphasis is given to the stability of the plate, due to

the fact that any minute vibration might severely degrade or completely destroy the recording.
Official Gazette of the U.S. Patent Office

N74-15147 Connecticut Univ., Storrs.
HOLOGRAPHIC INVESTIGATIONS USING PULSED LASERS Ph.D. Thesis
Peter Shajenko 1973 136 p
Avail: Univ. Microfilms Order No. 73-26582

A new source of coherent light energy is proposed for pulsed holographic applications. The proposed new source is the dye laser, whose active medium is a solution of one of several possible organic dyes. The most interesting properties of the dye laser pertinent to pulsed holography include high power capability with high efficiency, tunability across the visible spectrum, high reliability, and low cost of materials. Dyes can be selected and tuned to match the optimum transmissivity of the working medium. Because dye lasers can operate at two or more tunable frequencies, they are of potential importance in holographic contouring, which is a method for obtaining three-dimensional holographic images with range contours superimposed on the complex three-dimensional objects. The design and development of an experimental pulsed dye laser for holographic applications is described. The capabilities of the tunable-frequency dye laser for recording holograms are demonstrated. Dissert. Abstr.

N74-15148 Iowa State Univ. of Science and Technology, Ames.
REFERENCE PHASE MODULATION EFFECTS IN OPTICAL HOLOGRAPHY Ph.D. Thesis
Matthew John Golis 1973 178 p
Avail: Univ. Microfilms Order No. 73-26824

The dissertation examines the fundamental characteristics of fringe contrast and small-vibrations sensitivity found in optical holographic interferograms which have been made using temporal phase modulation. It establishes performance criteria against which future experimental evaluations can be compared. It establishes a basis upon which time-averaged sub-fringe holographic system performance can be evaluated, predicted on the hologram's optical noise level. It describes how the response of the system depends on the relative phase angles between the object and reference beam phase modulations. It reviews the general appearance of sub-fringe holographic interferograms and it demonstrates agreement of experimental and predicted results. It concludes that sub-fringe holography extends the useful range of vibrations-amplitude measurement but not to the degree suggested by some previous authors. Dissert. Abstr.

N74-15149*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
HIGH DATA RATE OPTICAL TRANSCEIVER TERMINAL Final Report, 30 Jun. 1972 - 26 Jan. 1973
E. S. Clarke May 1973 471 p refs
(Contract NAS5-23154)
(NASA-CR-132896) Avail: NTIS HC $25.75 CSCL 20E

The objectives of this study were: (1) to design a 400 Mbps optical transceiver terminal to operate from a high-altitude balloon-borne platform in order to permit the quantitative evaluation of a space-qualifiable optical communications system design, (2) to design an atmospheric propagation experiment to operate in conjunction with the terminal to measure the degrading effects of the atmosphere on the links, and (3) to design typical optical communications experiments for space-borne laboratories in the 1980-1990 time frame. As a result of the study, a transceiver package has been configured for demonstration flights during late 1974. The transceiver contains a 400 Mbps transmitter, a 400 Mbps receiver, and acquisition and tracking receivers. The transmitter is a Nd:YAG, 200 Mhz, mode-locked, CW, diode-pumped laser operating at 1.06 um requiring 50 mW for 6 db margin. It will be designed to implement Pulse Quaternary Modulation (PQM). The 400 Mbps receiver utilizes a Dynamic Crossed-Field Photomultiplier (DCFP) detector. The acquisition receiver is a Quadrant Photomultiplier Tube (QPMT) and receives a 400 Mbps signal chopped at 0.1 Mhz. Author

N74-15150*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CORRECTION OF LASER RANGE TRACKING DATA FOR ATMOSPHERIC REFRACTION AT ELEVATIONS ABOVE 10 DEGREES
J. W. Marini and C. W. Murray, Jr. Nov. 1973 60 p refs
(NASA-TM-X-70555; X-591-73-351) Avail: NTIS HC $5.00 CSCL 20E

A formula for correcting laser measurements of satellite range for the effect of atmospheric refraction is given. The corrections apply above 10 deg elevation to satellites whose heights exceed 70 km. The meteorological measurements required are the temperature, pressure, and relative humidity of the air at the laser site at the time of satellite pass. The accuracy of the formula was tested by comparison with corrections obtained by ray-tracing radiosonde profiles. The standard deviation of the difference between the refractive retardation given by the formula and that calculated by ray-tracing was less than about 0.04% of the retardation or about 0.5 cm at 10 deg elevation, decreasing to 0.04 cm near zenith. Author

N74-15151# Los Alamos Scientific Lab., N.Mex.
LASER PULSE SHAPING WITH NONLINEAR MATERIALS
J. M. Thorne and T. R. Loree Jul. 1973 6 p refs
(Contract W-7405-eng-36)
(LA-5323-MS) Avail: NTIS HC $4.00

The intensity-dependent light transmission of nonlinear optical materials can be used to tailor laser pulse shapes for CTR applications. Several interesting systems have been built and shown to be effective pulse shapers. Although pulse shapes matching any particular ideal shape for controlled thermonuclear reactions have not been demonstrated, the potential for producing such pulses is clearly evident. Calculations are presented to show how the optical parameters of the systems can be adjusted to give a wide variety of pulse shapes. These devices have response times in the picosecond range and can, in principle, be modified to operate in any part of the optical spectrum. Author (NSA)

N74-15152# Sandia Labs., Albuquerque, N.Mex.
HIGH-ENERGY HF LASER INITIATED BY AN INTENSE ELECTRON BEAM
E. L. Patterson and R. A. Gerber May 1973 12 p refs
(Contract AT(29-1)-789)
(SLA-73-881) Avail: NTIS HC $3.00

An experiment is described in which an intense electron beam, propagating in an SF6C2H6 mixture, is used to initiate chemical reactions that produce an HF laser. The variation of laser energy as a function of the pressure of SF6 at a fixed composition ratio and as a function of the composition ratio at a constant SF6 pressure was investigated. The maximum laser energy was approximately 200 J and was obtained with a mixture of 400-torr SF6 and 40-torr C2H6. The efficiency for converting deposited electron-beam energy to laser energy was as large as 8%. Author (NSA)

N74-15153# Sandia Labs., Albuquerque, N.Mex. Optics Div.
TECHNIQUE FOR PRECISE ALIGNMENT OF A POCKELS CELL IN A Q-SWITCHED LASER CAVITY
A. E. McCarthy Aug. 1973 5 p Sponsored by AEC
(SLA-73-689) Avail: NTIS HC $3.00

Use of this technique enhances control of the lasting action in a Q-switched laser cavity, reducing the possibility of unwanted long pulse or prelasing. This technique is useful in any Pockels cell laser cavity, but is especially valuable in cavities which use only a portion of the total cross sectional area of the lasing material. Author (NSA)

N74-15154# Sparcom, Inc., Alexandria, Va.
PRELIMINARY DESIGN CRITERIA, PERFORMANCE AND LIMITATIONS OF AN AIRBORNE LASER BATHYMETRIC SYSTEM
G. D. Hickman and A. H. Ghovanlou Aug. 1973 56 p refs
(Contract N00014-71-C-0202)
(AD-767391; TR-3) Avail: NTIS CSCL 08/10

Many of the salient parameters have been determined which define the capability and system requirements for an airborne laser/receiver bathymetric system operating in turbid waters. Laboratory transmission/scattering measurements which had been made of a pulsed blue-green neon laser through waters of varying turbidity were used to develop an empirical model for predicting the performance of an airborne laser bathymetric

system. The maximum depth measuring capability (alpha h) sub max) was determined to be approximately 15 attenuation lengths for a laser system operating at 30 kw/peak pulse from an altitude of 500 meters. The optimum scan angle of the laser transmitter was determined to be approximately 20 degrees while the scan rate for a laser pulsing at 100 pps was 0.8 seconds. Airborne and pier measurements are currently being conducted to test the validity of this empirical model. (Modified author abstract) GRA

N74-15155# Esso Research and Engineering Co., Linden, N.J. Government Research Lab.
HEAT PIPE COPPER VAPOR LASER Semiannual Technical Report, 1 Feb. - 30 Sep. 1973
Robert J. L. Chimenti 8 Oct. 1973 8 p
(Contract N00014-73-C-0317; ARPA Order 1806)
(AD-768364; GRUS.1REOA.73) Avail: NTIS CSCL 20/5

The report describes the development of a heat pipe copper vapor laser with radial discharge excitation and operating temperatures to 2000C. Author (GRA)

N74-15156# Raytheon Co., Waltham, Mass. Research Div.
VISIBLE AND INFRARED LASER-INDUCED DAMAGE TO TRANSPARENT MATERIALS Semiannual Technical Report, 1 Jan. - 30 Jun. 1973
Michael Bass, David W. Fradin, and Domenic P. Bua Sep. 1973 94 p refs
(Contract F19628-73-C-0127; ARPA Order 1434)
(AD-768621; S-1593; AFCRL-TR-73-0494) Avail: NTIS CSCL 20/5

By using Q-switched and mode-locked Nd:YAG lasers, the authors have measured the dependence of intrinsic damage fields on both lattice disorder and laser pulse duration and have interpreted the results in terms of avalanche breakdown. It was found that severe lattice disorder such as present in fused silica measurably increases the intrinsic damage intensity. The breakdown field was also found to increase when the pulse duration was reduced below about 1 ns. Damage from inclusions was observed in various dielectric coatings. It was found that inclusions having diameters approximately 3.5 micrometers were responsible for damage from Q-switched pulses and that inclusions with diameters less than approximately 0.4 micrometers were responsible for threshold damage from 20 ps mode-locked pulses. An operating CO2 TEA laser has been assembled for use as a source for damage measurements. Future cavity refinements are needed to restrict lasing to a TEM(00) mode with peak powers in excess of about 150 KW. Author (GRA)

N74-15157# Air Force Ballistic Missile Div., Patrick AFB, Fla.
LASER DAMAGE IN DIELECTRIC COATINGS: IDENTIFICATION OF INCLUSIONS AS THE LIMITING DAMAGE MECHANISM AND FIRST OBSERVATION OF INTRINSIC DAMAGE IN DIELECTRIC COATINGS Physical Sciences Research Papers, 1 Jan. - 30 Jun. 1973
D. Milam, R. A. Bradbury, R. H. Picard, and M. Bass 10 Jul. 1973 41 p refs
(ARPA Order 1434; AF Proj. 6100)
(AD-768674; AFCRL-TR-73-0406; AFCRL-PSRP-553) Avail: NTIS CSCL 20/5

Inclusion damage due to metallic or highly absorbing inclusions has been conclusively identified as the practical limitation in the threshold for laser-induced dielectric film damage at the wavelength 0.69 micrometer. The predicted pulse duration-inclusion size relationship has been observed. It has been shown that linear absorption is not a limiting damage mechanism when films are properly prepared from materials which do not show bulk absorption. The first verified observation of intrinsic damage in dielectric films is discussed. Author (GRA)

N74-15158# Hughes Research Labs., Malibu, Calif.
FREQUENCY TUNED CO2 LASER Semiannual Technical Report, 19 Mar. - 31 Sep. 1973
R. L. Abrams Oct. 1973 49 p refs
(Contract N00014-73-C-0324; ARPA Order 1809)
(AD-769067) Avail: NTIS CSCL 20/5

The program represents an effort to develop a stable, tunable CO2 laser with a tuning range of plus or minus 750 MHz. In order to increase the tuning range of a CO2 laser beyond the 50 to 100 MHz Doppler broadening limited value, it is necessary to increase the gain linewidth. The technical approach taken here is to raise the operating laser pressure and thus broaden the gain linewidth. The linewidth broadens at the rate of 5.3 MHz/torr and equals 1500 MHz at 283 torr. High pressure operation is achieved by operating the laser in the waveguide mode, and thus using a small capillary bore as the gas discharge region. (Modified author abstract) GRA

N74-15159# Hughes Research Labs., Malibu, Calif.
LASER-INDUCED DAMAGE IN OPTICAL MATERIALS Semiannual Technical Report
Concetto R. Giuliano Jul. 1973 45 p refs
(Contract F19628-72-C-0348; ARPA Order 2042; AF Proj. 2042)
(AD-768972; AFCRL-TR-73-0528; SATR-2) Avail: NTIS CSCL 20/6

The report contains the results of damage experiments performed at 0.694 and 1.06 micrometer using well controlled ruby and Nd:YAG lasers. Materials studied at 1.06 micrometer are proustite (Ag3AsS3) and lithium niobate (LiNbO3). Proustite studies have been directed toward improving surface quality by employing different polishing techniques. Little or no improvement has been obtained over previously measured thresholds. Chemical changes in proustite damage sites are evidenced by the use of electron excited X-ray microprobe measurements. Preliminary ion beam polishing experiments were performed on LiNbO3, but no improvement in damage threshold was observed. However, the damage in this material appears to be inclusion limited in the samples studied so far. The temporal and spatial characteristics of laser pulses were studied for transmitted, reflected, and backscattered pulses both above and below surface damage threshold. (Modified author abstract) GRA

N74-15160# Naval Ordnance Lab., White Oak, Md.
A NUMERICAL ANALYSIS OF CO2 LASER RADIATION ABSORPTION IN SF6 AIR LAMINAR BOUNDARY LAYERS
John D. Anderson, Jr. 12 Jul. 1973 43 p refs
(ZR00001010)
(AD-768752; NOLTR-73-143) Avail: NTIS CSCL 20/5

Numerical results are presented for the radiative gas dynamic interaction associated with CO2 laser radiation absorption in SF6-air laminar compressible boundary layers. Detailed boundary layer profiles and the variation of radiative intensity are obtained for the sonic flow over a flat plate at sea level, wherein SF6 is injected into the boundary layer through the surface, and CO2 laser radiation at 10.6 micrometers is incident on the plate downstream of the injection. The numerical solution of the non-similar boundary layer equations employs a difference-differential technique. (Modified author abstract) GRA

N74-15161# Avco-Everett Research Lab., Everett, Mass.
PULSED CHEMICAL LASER SCIENCE AND TECHNOLOGY Final Report, 8 Nov. 1971 - 1 Dec. 1972
Oct. 1973 185 p refs
(Contract F29601-72-C-0017; ARPA Order 870; AF Proj. 0870)
(AD-769040; AFWL-TR-73-40) Avail: NTIS CSCL 20/5

Research is described on a pulsed chemical laser operating on the reaction between hydrogen and fluorine at pressures above the second explosion limit. Laser energy density and efficiency are reported. The highest vibrational level observed to give laser action is v - 6, and it is concluded that rapid deactivation of the upper vibrational levels initial F-atom concentration required for good laser performance, overall electrical efficiencies of greater than 100% are predicted. Attempts have also been made to develop (1) fast yet accurate computer programs which contain the essential physics for the calculation of the vibration-relaxation cross section in an atom molecule collision, and (2) theoretical model of the propagation of a collimated pulsed laser beam in an absorbing medium. The energy absorbed by the medium causes heating, leading to an index-of-refraction change which causes a self-defocusing. (Modified author abstract) GRA

N74-15162# Battelle-Northwest, Richland, Wash.
INVESTIGATE MATERIAL SYSTEMS FOR MIRRORS USED IN HIGH POWER CO AND CO2 LASERS Semiannual

Technical Report
R. W. Stewart Aug. 1973 37 p refs
(Contract N00123-72-C-2215; ARPA Order 2175)
(AD-769103; BNWL-1781) Avail: NTIS CSCL 20/5

An IR metal mirror with up to approximately 99.2% reflectivity and a surface roughness of about 15 A rms was developed using high-rate sputter-deposition techniques. The necessary smooth, high-conductivity surface was obtained by applying two sequentially deposited metal layers on a high-conductivity metal mirror support (OFHC). The principal property of the first deposit was its polishability and of the second its high electrical conductivity. The required smooth surface was obtained by depositing and mechanically polishing a dispersion-hardened (1 vol.%SiC in Cu), stable, fine-grained material about 0.5 mm thick. (Modified author abstract) GRA

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N74-15163 British Library Lending Div., Boston Spa (England).
STRENGTH INCREASE BY REACTIONS IN THE LIQUID STATE
F. Erdmann-Jesnitzer 5 Jul. 1973 13 p refs Transl. into ENGLISH of paper presented at Intern. Creep Conf., Duesseldorf, 3-5 May 1972
(CE-Trans-6035) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

Regions of ordered distribution of two alloying elements were produced in the liquid parent metal which may continue until precipitation of discrete phases. During solidification these freeze and thus set up obstacles to migration of dislocations in the solid metal. Test results for armco-iron and austenitic steel showed that it is possible to improve the creep strength considerably at 600 C. Author

N74-15164 British Library Lending Div., Boston Spa (England).
DISPERSIONS OF CARBIDES AND NITRIDES IN COBALT AND NICKEL
D. Thibaudon, M. Roubin, and R. A. Paris 5 Jul. 1973 27 p refs Transl. into ENGLISH from J. Less-Common Metals (Lausanne), v. 29, 1972 p 171-182 In ENGLISH and FRENCH
(BLL-LTI-746-1452-(9022.401)) Avail: British Library Lending Div., Boston Spa, Engl.: 3 BLL photocopy coupons

Dispersions of refractory carbides and nitrides in cobalt and nickel and dispersions of cobalt in a number of carbides were prepared by chemical means. A gas-solid reaction was used in conjunction with mixtures of H2-CH4 or H2-NH3 to respectively reduce and carbonize or reduce and nitrate the ground materials. Through the use of high quality starting materials it is possible to obtain products which are characterized by a very homogeneous distribution of the dispersed phase in the matrix. Author

N74-15165 British Library Lending Div., Boston Spa (England).
DEVELOPMENT, TREATMENT AND APPLICATIONS OF NITROGEN-ALLOYED HIGH-MOLYBDENUM STEEL X 3 CrNiMoN 17 13 5
A. Baumel, E. M. Horn, and G. Siebers 5 Jul. 1973 26 p refs Transl. into ENGLISH from Werkstoffe Korrosion (Weinheim), v. 23, 1972 p 973-983 In ENGLISH and GERMAN
(BLL-LTI-746-1449-(9022.401)) Avail: British Library Lending Div., Boston Spa, Engl.: 3 BLL photocopy coupons

The effects of nitrogen additions on the precipitation behavior of high molybdenum steels are discussed. Data are also given on the tensile, physical, and welding properties of the steel. Special corrosion properties including pitting resistance, crevice corrosion, stress corrosion cracking, and corrosion behavior in mixed acids are examined. E.H.W.

N74-15166 British Library Lending Div., Boston Spa (England).
SOME RESULTS OF AN INVESTIGATION OF THE TERNARY TUNGSTEN-NICKEL-BORON SYSTEM
S. S. Kiparisov, O. A. Nikiforov, and Yu. K. Kuzmina 5 Jul. 1973 10 p Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Tsvet. Met. (USSR), no. 2, 1972 p 88-91 In ENGLISH and RUSSIAN
(BLL-LTI-746-1456-(9022.401)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

Twelve alloys were prepared in a laboratory electric-arc furnace with cooled ingot molds of copper, using a tungsten electrode in a medium of purified and dried helium. In order to prevent evaporation of boron under the high temperature melting conditions, briquettes compacted from a mixture of tungsten borides with nickel were added to the melt. The borides were previously prepared by synthesis from their elements in vacuum at 1200-1300 degrees. The cast alloys were sintered for 60 hr. at 1200 deg in the TVV-4 laboratory furnace in a vacuum of 0.0005 mm Hg and then cooled outside the furnace. Chemical analysis of the finished alloys showed that their compositions after melting and sintering differed little from the starting compositions. Taking the prepared alloys, the microstructure was investigated, the microhardness of the structural components was determined, X-ray phase analysis was performed, and the distribution of nickel across a microsection of the specimens was studied using the X-ray microanalyser. Author

N74-15167 British Library Lending Div., Boston Spa (England).
INFLUENCE OF CHROMIUM ON THE ACTIVITY OF CARBON IN THE IRON-CHROMIUM-CARBON SYSTEM AT 1000 C
K. Bungardt, H. Preisendanz, and G. Lehnert 5 Jul. 1973 18 p Transl. into ENGLISH from Arch. Eisenhuettenw. (West Germany), v. 35, no. 10, Oct. 1964 p 999-1007
(BLL-Risley-TR-2635-(9091.9F)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

The influence of chromium on the range of existence for the gamma phase was investigated. The carbon activity variation in the iron-chromium-carbon system was used for the investigation. An installation was developed for determining the carbon activity with methane-hydrogen mixtures and the range of existence for the homogeneous gamma phase was studied using iron-chromium alloys at 1000 C. The design of the test equipment and the method for conducting the tests are described. The preparation of the specimens for the tests is reported. On the basis of the iron-carbon phase diagram, it is expected that at 1000 C the activity of the carbon in the homogeneous austenite range will increase uniformly as the carbon content increases. Author

N74-15168 British Library Lending Div., Boston Spa (England).
HOT ISOSTATIC PRESSING: A NEW PRODUCTION METHOD FOR HARD METAL AND ALLOY STEEL
Rune Johansson 3 Sep. 1973 29 p Transl. into ENGLISH from the SWEDISH In ENGLISH and SWEDISH
(BLL-NEL-TT-2507-(6075.461)) Avail: British Library Lending Div., Boston Spa, Engl.: 3 BLL photocopy coupons

After many years of research, hot isostatic pressing is now ready for production, since processes have been developed, and isostatic presses designed for high pressures and high temperatures and for large dimensions and short cycle times are available. The production of tungsten carbides and of high speed tool steels by means of isostatic pressing are described. Tungsten carbide is a dense material yet there always remain in it a number of pinholes that sharply diminish the strength of the material. By using the hot isostatic method of pressing the pinhole volume has been reduced by factors of 100 to 1000 and the life span of high pressure dies increased six fold. Conventional high speed tool steel shows a marked tendency to segregation and an irregular coarse-grained structure. By powder metallurgical processes a material of very fine grain structure can be accomplished. The carbide grain-size is 1 micron or smaller and, moreover, segregation in the material is completely averted. The service life of drills made of hot isostatic pressed high speed tool steel is extended by 390 per cent. Author

N74-15169 British Library Lending Div., Boston Spa (England).

RESEARCH WITH AN EMISSION MICROSCOPE INTO A COPPER-ZIRCONIUM ALLOY AFTER INTERNAL OXIDATION

V. E. Skazin Nov. 1973 11 p refs Transl. into ENGLISH from Fiz. i Khim. Orabotki Materialov (USSR), v. 3, 1972 p 86-90

(BLL-RTS-8525) Avail: British Library Lending Div., Boston Spa, Engl.: £1.00 or 3 BLL photocopy coupons

A method for investigating copper alloys containing up to 1.5 percent Zr after internal oxidation is presented; an emission microscope was used. The particle distribution of the second phase is given, along with recrystallization effects of the metal matrix. Author

N74-15170 British Library Lending Div., Boston Spa (England).

THE IONIC CONDUCTIVITY OF BETA-ALUMINA

I. Uei and Toshihiko Nishida Aug. 1973 24 p refs Transl. into ENGLISH from Asahi Garasu Kogyo Gijutsu Shoreikai Kenkyu Hokoku (Japan), v. 19, 1971 p 69-86

(BLL-RTS-7864) Avail: British Library Lending Div., Boston Spa, Engl.: £2.30; 8 BLL photocopy coupons

The ionic conductivity of the beta alumina single crystal was determined. The correlation between ionic conductivity data for polycrystalline sintered compacts from powdered beta-Al2O3 brick and factors affecting conductivity was investigated. The feasibility of preparing beta alumina of increased ionic conductivity at a lower temperature was examined by chemical synthesis and sintering. Author

N74-15171 British Library Lending Div., Boston Spa (England).

THE STRENGTH OF COPPER-ZIRCONIUM-CHROMIUM ALLOY IN RELATION TO ITS AGED STRUCTURE

Hisashi Suzuki, Motohiro Kanno, and Ichiro Kawakatsu Oct. 1973 15 p refs Transl. into ENGLISH from Nippon Kinzoku Gakkai-shi (Sendai City), v. 33, no. 5, 1969 p 628-633

(BLL-RTS-8518) Avail: British Library Lending Div., Boston Spa, Engl.: £1.40 or 5 BLL photocopy coupons

An analysis was conducted to determine and compare the strengths of copper-zirconium-chromium alloys with copper-zirconium and copper-chromium alloys. An investigation into the aged structure of copper-zirconium-chromium alloy by transmission electron microscopy is discussed. The strength of the alloy is explained in terms of the microstructure. The superiority in low temperature and high temperature strength of copper-zirconium-chromium alloys as compared with binary alloys was attributed to the finer precipitate, its denser distribution, and the larger quantity than in the binary alloys for the same aging conditions. Author

N74-15172 British Library Lending Div., Boston Spa (England).

THE STRUCTURE OF DRAWN MARTENSITE AND THE PROCESSES OF DRAWING TEMPERED STEEL

G. Kurdyumov and N. Oslon Oct. 1973 38 p refs Transl. into ENGLISH from Zh. Tekhn. Fiz. (Leningrad), v. 9, no. 21, 1939 p 1891-1909

(BLL-RTS-8130) Avail: British Library Lending Div., Boston Spa, Engl.: £3.70; 12 BLL photocopy coupons

In order to study the structure of drawn martensite, measurement were made of the breadth of the interference lines and the constant of the lattice in chilled and drawn steels with a different carbon content from 0.11 to 1.18%. (1) The distinct path of change in the breadth of the lines for different faces, and also the dissimilar change in the constant of the lattice, found for different faces, shows that chilled steel of low carbon content, with a carbon content of up to 0.5%, has a tetragonal lattice. The constant of the lattice is a function of the carbon content. (2) The ratio of the breadth of the lines for the different faces, and the changes in the constant of the lattice during the drawing process show that the tetragonal structures are preserved both for steels with a low carbon content and for those with a high carbon content up to drawing temperature of 275-300 deg; in steels with a high or an average carbon content the structure is formed when the drawing takes place within the range of temperatures of 100-150 deg. (3) The data obtained permit assertation that martensite with a cubic lattice does not exist. (4) Results obtained enable assessments to be made of the qualitative X-ray characteristics of the martensite of chilled steels of low carbon content and of the martensite of the drawing. Author

N74-15173 British Library Lending Div., Boston Spa (England).

THE NATURE OF PHOSPHORUS IN INDUSTRIAL MANGANIFEROUS FERROALLOYS

V. S. Ignatev, R. S. Mashkovtseva, L. N. Gasik, A. N. Kurasov, and V. S. Tkhorevskii [1973] 11 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Chern. Met. (Moscow), no. 4, 1973 p 74-77 In ENGLISH and RUSSIAN

(BLL-M-21739-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

The phase composition of high-carbon ferromanganese and industrial silicomanganese was analyzed. Metallographic and local micro X-ray spectrographic analysis was employed. A study of the form in which phosphorus was present showed that the phosphorus in these alloys is introduced into the eutectic on the basis of a complex phosphide and a solid solution of phosphorus and silicon in the iron-manganese matrix, stable below 1000 C. The advantages of the binding of phosphorus in phosphide with the iron are shown. Author

N74-15174 British Library Lending Div., Boston Spa (England).

THE FRACTURE CONDITION IN METALS DURING VARIABLE-SIGN DEFORMATION WITH AN ARBITRARY CYCLE SHAPE

A. A. Bogatov [1973] 11 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern Met. (USSR), v. 4, 1973 p 102-104 in ENGLISH and RUSSIAN

(BLL-M-21738-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

A model employing the plasticity reserve during cyclic deformation which allows for the possibility of repair to the crack and pore type defects is proposed. Using this model, the fracture condition in metals during plastic deformation was established. The validity of the proposed model was assessed from a series of cyclic torsion tests with an arbitrary cycle shape. Author

N74-15175 British Library Lending Div., Boston Spa (England).

BOOK REVIEW: THE PLASTIC DEFORMATION OF HIGH ALLOY STEELS AND ALLOYS

S. I. Bulat [1973] 9 p refs Transl. into ENGLISH from Stal (Moscow), v. 4, 1973 p 364-365

(BLL-M-21752-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

The technologies for heating, forging, rolling, and pressing components made of industrial complex alloyed steels and alloys on an integrated basis were investigated. The physical and chemical processes which develop in them, as well as the changes in their structures and properties were considered. Author

N74-15176 British Library Lending Div., Boston Spa (England)

THE DEFORMABILITY OF METALS DURING PRESSURE WORKING

Ya. M. Okhrimenko [1973] 9 p Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (USSR), v. 5, 1973 p 84-88

(BLL-M-21764-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

An analysis is made of the condition and nature of the deformability limit of metals, and of the empirical and limited nature of the understanding of plasticity. A new metal deformability characteristic expressing the capacity of metals for profiling during deformation is proposed with a view to expanding the media used for the development of technological metal pressure working processes. Author

N74-15177 British Library Lending Div., Boston Spa (England).

SOLUTION OF STATISTICAL PROBLEMS OF THE PROCESSING OF METALS BY PRESSURE, COMMUNICATION 2
B. M. Gotlib [1973] 10 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (USSR), v. 6 1973 p 63-66
(BLL-M-21788-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

The solution of boundary statistical problems of the treatment of metals by pressure with arbitrary mechanical properties of the medium was considered. Physical equations were obtained for an isotropic, incompressible and macro-heterogeneous medium. The solution of the problem was found for a specific stress-strain state of the metal in upsetting the stock (the two-dimensional problem) and random mechanical properties of the billet. An analysis is presented of the effect of various factors on the amount of scatter of the stresses and strains. Author

N74-15178 British Library Lending Div., Boston Spa (England).
INVESTIGATION OF THE EFFECT OF THE ALPHA PHASE IN MAGNETIC ALLOYS OF THE MAGNIKO TYPE ON REDUCTION OF BRITTLENESS
Ya. M. Dovgalevskii, K. I. Vlaskina, A. D. Loiko, and Yu. I. Pokrovskii [1973] 6 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern Met. (Moscow), v. 5, 1973 p 123-127
(BLL-M-21776-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

Studies were made of the fracture of Magniko alloys in the high-coercivity condition and in the structural presence of distributed face centered cubic lattices phases. The alpha phase of the material led to predominately transcrystalline fracture and increased the work expended in initiation and propagation of cracks. Both factors tended to reduce the brittleness and this was confirmed by mechanical test data. Author

N74-15179 British Library Lending Div., Boston Spa (England).
FEATURES OF THE IMPREGNATION OF GRAPHITE WITH LIQUID REFRACTORY METALS
V. I. Kostikov and G. D. Pososeva [1973] 9 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern Met. (USSR), v. 5, 1973 p 17-19
(BLL-M-21772-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

Different theories of capillary impregnation were considered. An equation is proposed for the movement of metal in the graphite pores for a system with an intensive chemical interaction. The functional relationship h = f(liquid/metal contact time) was confirmed experimentally. Author

N74-15180 British Library Lending Div., Boston Spa (England).
INVESTIGATION OF NON-METALLIC INCLUSIONS CONTAINING RARE EARTH METALS
V. E. Roshchin, D. Ya. Povolotskii, V. F. Nosach, and A. V. Rechkalova [1973] 7 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (Moscow), v. 6, 1973 p 110-113
(BLL-M-21798-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

Residues were examined following the electrolytic solution of samples containing rare earth metals. It was found that most of the inclusions containing rare earth metals were broken up. The comparatively stable phases are CeO2 and LaAlO3. A method of dry preparation is suggested for analyzing unstable compounds. This consists of etching the surface of the micro-section with argon ions in an electrical field, examining the surface of the etched section by diffraction in the electron microscope with the subsequent making of a carbon replica. This method of examination revealed the existence of finely dispersed inclusions CeN, CeC3 and La2O3 in the metal. The hypothesis is put forward that the precipitation or finely dispersed inclusions at the grain boundaries during crystallization has an inoculating action. Author

N74-15181 British Library Lending Div., Boston Spa (England).
PROPERTIES OF HIGH STRENGTH AUSTENITIC STEELS AT LOW TEMPERATURES
Yu. K. Koweristyi, V. M. Blinov, and V. N. Volynskii [1973] 3 p Transl. into ENGLISH from Stal (Moscow), v. 4, 1973 p 365
(BLL-M-21751-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

The mechanical properties of high-strength precipitation-hardened austenitic steel are discussed along with surface hardening of nonmagnetic steels after nitriding. F.O.S.

N74-15182*# Carnegie-Mellon Univ., Pittsburgh, Pa. Metals Research Lab.
THE EFFECT OF MICROSTRUCTURE ON THE FRACTURE TOUGHNESS OF TITANIUM ALLOYS
R. H. VanStone and J. R. Low, Jr. Oct. 1973 55 p refs
(Grant NGR-39-087-047)
(NASA-CR-136553; TR-1-Ti) Avail: NTIS HC $4.75 CSCL 11F

The high-strength titanium alloys are widely used in aircraft and aerospace structures due to their high strength to density ratios. In such applications, the fracture toughness rather than the strength is often the factor which requires larger size sections and lower useful payloads. The response of the strength and toughness of titanium alloys was analyzed generally without regard to the fracture mode or the effect of microstructure on the fracture mechanisms. Research on the fracture mechanisms in aluminum alloys and steels showed that the toughness may be improved by decreasing the sizes of inclusions and sub-micron precipitates. An investigation was conducted to study the fracture mechanisms in titanium alloys which may lead to suggestions for the improvement of the fracture toughness without a corresponding loss in strength. Author

N74-15183# National Aeronautical Lab., Bangalore (India). Propulsion Div.
DISPERSION HARDENING IN POWDER METALLURGY
Werner Schatt [1972] 28 p refs Transl. into ENGLISH from Neue Hutte (Dresden), v. 2, Feb. 1970
(NAL-TR-128) Avail: NTIS HC $3.50

Theories and methods of increasing deformation resistance in metallic materials are reported. Special attention was given to dispersion alloying by the powder metallurgy technique. Data are also included on stable dispersal structures of the sinter and precipitating dispersion alloys produced at high temperature and their resistance in regard to recovery, recrystallization, and creep rate. E.H.W.

N74-15184# National Aeronautical Lab., Bangalore (India).
EFFECT OF SHORT TIME HEATING UNDER LOAD ON THE PRECIPITATION HARDENING IN COMMERCIAL ALUMINUM ALLOYS
G. Ziegler and K. Welpmann Nov. 1973 47 p refs Transl. into ENGLISH of "Einfluesse von kurzzeitiger Erwaermung unter Belastung auf die Aushartung technischer Aluminium-Legierungen", DFVLR, Mater. Sci. Res. Inst., Porz-Wahn, West Germany, report DLR-FB-71-111
(NAL-TR-191; DLR-FB-71-111) Avail: NTIS HC $4.75

The investigations of commercial alloys of Al Cu Mg after short time heating in the temperature range of 150 C to 300 C for times from 1 to 8 min. were carried out by electrical resistance measurement and electron microscopic inspection. Under the conditions chosen, the following results were obtained. A short time heating at 250 C (up to 2 min) the three age hardened alloys showed a large decrease in tensile strength. For Al Cu Mg 1 and Al Sn Mg Cu 0.5 the short time heating from 180 C to 200 C caused a considerable strength reduction. The tensile strength was particularly affected by short time heating rather than the yield strength and hardness value. For the consideration of structural parts the age hardened Al-alloys must take into account (when the possibility of a short time heating is not encountered) the reduction in tensile strength of 38% for Al Cu Mg 1, 18% for Al Cu Mg 2 and 49% for Al Zn Cu 0.5 due to age hardening conditions. Author

N74-15185*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PROPERTIES OF DISPERSION-STRENGTHENED CHROMIUM - 4-VOLUME-PERCENT-THORIA ALLOYS PRO-

DUCED BY BALL MILLING IN HYDROGEN IODIDE
Alan Arias Washington Jan. 1974 30 p refs
(NASA-TN-D-7512; E-7620) Avail: NTIS HC $3.00 CSCL 11F

The effects of processing variables on the tensile properties and ductile-to-brittle transition temperature (DBTT) of Cr + 4 vol. %ThO2 alloys and of pure Cr produced by ball milling in hydrogen iodide were investigated. Hot rolled Cr + ThO2 was stronger than either hot pressed Cr + ThO2 or pure Cr at temperatures up to 1537 C. Hot pressed Cr + ThO2 had a DBTT of 501 C as compared with minus 8 to 24 C for the hot rolled Cr + ThO2 and with 139 C for pure Cr. It is postulated that the dispersoid in the hot rolled alloys lowers the DBTT by inhibiting recovery and recrystallization of the strained structure. Author

N74-15186# Joint Publications Research Service, Arlington, Va.
COMPOUNDS OF RARE EARTH METALS WITH COBALT (RCo5) AS MATERIALS FOR PERMANENT MAGNETS
V. S. Kraposhin and Ya. L. Linetskiy 28 Dec. 1973 11 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Tsvetn. Met. (Dzaudzhikau) no. 6, 1972 p 111-117
(JPRS-60877) Avail: NTIS HC $3.00

Data on the development of methods of obtaining permanent magnets made of RCO5 compounds. Author

N74-15187# Joint Publications Research Service, Arlington, Va.
PHASE TRANSFORMATIONS AND PROPERTIES OF ALLOYS UNDER HIGH PRESSURE
A. Ya. Shinyayev 7 Jan. 1974 26 p refs Transl. into ENGLISH from the book "Fazovyye Prevrashcheniya i Svoystva Splavov privysokom Davlenii" Moscow, Nauka, 1973 p 132-150
(JPRS-60917) Avail: NTIS HC $3.50

The effects of pressure on the physical and mechanical properties of various substances were investigated. A phase transition to a new modification may occur at room temperature or increased temperature. After removal of the pressure, in some cases, the system momentarily is transformed to the initial situation and in other cases the system may stay for a long time in a metastable state. A thermodynamic analysis of the transformation process is developed. Pressure-temperature diagrams of various substances are included. Examples of microstructure resulting from high pressures are presented. The effects of pressure on the growth rate of crystals are analyzed. Author

N74-15188*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPLORATORY STUDY OF ELEVATED-TEMPERATURE TENSILE PROPERTIES OF ALLOYS BASED ON THE INTERMETALLIC COMPOUND TiNi
Marvin Garfinkle Washington Jan. 1974 29 p refs
(NASA-TN-D-7531; E-7584) Avail: NTIS HC $3.00 CSCL 11F

The tensile properties and oxygen contamination behavior of TiNi alloyed with aluminum, chromium, and silicon were investigated in the temperature range between 800 and 1000 K (980 and 1340 F). The alloys were significantly stronger than unalloyed TiNi and less susceptible to embrittlement than the Ti-6242 alloy. Author

N74-15189*# Kanner (Leo) Associates, Redwood City, Calif.
INTERACTION OF INTERSTITIAL IMPURITIES WITH IRON SUBGROUP METALS IN AS-CAST MOLYBDENUM-BASED DILUTE SOLID SOLUTIONS
N. V. Ageyev, N. N. Bokareva, Z. A. Guts, D. V. Ignatov, M. M. Kantov, M. S. Model, and S. G. Romanchenko Washington NASA Jan. 1974 22 p refs Transl. into ENGLISH from the book "Khimiya Metallicheskikh Splavov" Moscow, Nauka Press, 1973 p 114-123
(Contract NASw-2481)
(NASA-TT-F-15281) Avail: NTIS HC $3.25 CSCL 11F

The structure and properties of low-alloy Mo-Fe, Mo-Co, and Mo-Ni castings were examined in order to determine the nature of the positive influence exerted by small additions of iron-subgroup metals (Fe, Ni, Co) on the properties of cast molybdenum containing interstitial impurities in amounts (0.012 wt. %) characteristic of the current level of industrial technology. Comparison of the concentration dependence of some mechanical and physical properties with the changes arising in fine structure during alloying indicates that the rise in plasticity over a narrow range of additive concentration (0.1 to 0.2 atom %) is not accompanied by any significant change in the solubility of interstitial impurities in molybdenum. Author

N74-15190# Oak Ridge National Lab., Tenn.
RESISTANCE OF AUSTENITIC STEEL IN CONTACT WITH LIQUID SODIUM DURING THERMAL CYCLING
Yu. F. Balandin and A. F. Malgyin [1973] 5 p refs Transl. into ENGLISH from Fiz. Khim. Mekhan. Materialov, Akad. Nauk Ukr. SSR (Kiev), v. 8, no. 5, 1972 p 57-59 Sponsored by AEC
(ORNL-TR-2705) Avail: NTIS HC $3.00

The effects of liquid sodium on the thermal fatigue resistance of Cr-Ni austenitic steels were studied. It was found that air and cooling water are relatively more aggressive media than liquid sodium with regard to thermal fatigue in these steels. The results obtained agree with literature data on the effects of sodium on high-temperature resistance to fatigue. NSA

N74-15191# Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Inst. fuer Strahlenschutz.
DECONTAMINATION OF STEELS
H. Sorantin and E. Huber Jun. 1973 18 p refs In GERMAN; ENGLISH summary
(SGAE-2145) Avail: AEC Depository Libraries HC $3.00

Steel surfaces contaminated with Co-80, Sr-85, Zr-95, Ru-106, Cs-137 could be cleaned most efficiently with solutions having a pH-value under 4. Of different reagents a solution of 5% EDTA showed best results and lowest corrosion rates after addition of 2% Lutensol-AP 14. An evaluation method for comparing decontamination efficiencies of different solutions was proposed that also takes into account the corrosion rate during the time of application. Author (NSA)

N74-15192# Southwest Research Inst., San Antonio, Tex.
HEAVY SECTION STEEL TECHNOLOGY PROGRAM TESTS OF 6-INCH-THICK TENSILE SPECIMENS. TESTS OF 1-INCH-THICK FLAWED TENSILE SPECIMENS FOR SIZE EFFECT EVALUATION Technical Summary Report
S. C. Grigory Jun. 1973 113 p refs Prepared for ORNL
(Contract W-7405-eng-26)
(HSSTP-TR-23; TSR-4) Avail: NTIS HC $7.75

Results are presented of tests on 1-inch-thick specimens of A533B steel specimens geometrically similar to the large 6-inch-thick specimens. Test procedures and notch sharpening methods are summarized. The data and information are presented in sections and appendixes on test facility and specimen design, instrumentation and test results, clip gage data, strain data, and strain data from x-y plotter. NSA

N74-15193# Philco-Ford Corp., Newport Beach, Calif. Aeronutronic Div.
DEVELOPMENT OF TECHNOLOGY TO SHEAR SPIN VACUUM-HOT-PRESSED BERYLLIUM Final Report
R. P. Sernka Nov. 1972 101 p refs Prepared for Sandia Labs., Livermore, Calif. Sponsored by AEC
(SCL-CR-720179) Avail: NTIS HC $7.25

Feasibility demonstration of power shear spinning vacuum-hot-pressed beryllium, development of technology to shear spin the cap-hat component, and demonstration of shear spinning heavy-wall beryllium were conducted. Mechanical properties, crystallographic texture, and microstructural characterization were determined before and after shear spinning. Processing parameters such as forming temperature, rotational speed, forming roller axial feed rate, amount of deformation, forming roller configuration, and machine deflection allowance were determined. As a result of shear spinning to 67% reduction, beryllium exhibits an increase in basal plane crystallographic texture from 1.0 random to 5.0 random. The 67% reduction also causes an increase in longitudinal tensile properties of 34 and 25 KSI for yield and ultimate strengths, respectively. Author (NSA)

N74-15194# Maryland Univ., College Park.
INVESTIGATION OF IRRADIATION STRENGTHENING OF bcc METALS AND SOLID SOLUTIONS, PART 2 Progress

Report, Jan. - Oct. 1973
1973 207 p refs
(Contract AT(40-1)-3612)
(ORO-3612-10-Pt-2) Avail: NTIS HC $12.50

A review is presented of the low-temperature deformation of bcc metals and their solid-solution alloys. Topics covered include: asymmetry of slip and yielding, dislocation configurations, core structure of screw dislocations, thermal activation analysis of dislocation dynamics, interstitial alloys, hydrogen alloys, substitutional alloys, radiation effects, and superconducting state. NSA

N74-15195# Los Alamos Scientific Lab., N.Mex.
STRENGTHENING OF LIQUID SINTERED TUNGSTEN ALLOYS
J. M. Dickinson, R. E. Riley, and J. M. Taub 1972 24 p refs Presented at 4th Intern. Conf. on Powder Met., Toronto, 15 Jul. 1973
(LA-UR-73-919; Conf-730718-1) Avail: NTIS HC $3.25

A rather large number of W-base liquid-phase alloys were made and studied. The high strength values, high densities, and high modulus values desired were obtained. Although the ductilities were generally good in compression, brittle failure was the rule in tension. Rhenium in particular had a strong strengthening effect. The high hardness and brittleness of the high Re content alloys can be explained by the sigma phase present in the matrix. While alloy matrix W alloys show promise, difficulty in obtaining small sizes of alloy powders having a good particle size distribution is a serious drawback. Tungsten alloys made with Co-Ni plated W proved interesting. Good properties were obtained under carefully controlled sintering conditions to give a structure that appears to be a result of both solid and liquid phase sintering. Author (NSA)

N74-15196# Naval Research Lab., Washington, D.C.
CORROSION CHARACTERIZATION AND RESPONSE TO CATHODIC PROTECTION OF EIGHT WIRE ROPE MATERIALS IN SEA WATER Final Report
T. J. Lennox, Jr., R. E. Groover, and M. H. Peterson 12 Sep. 1973 56 p refs
(AD-767924; NRL-7584) Avail: NTIS CSCL 11/6

The corrosion behavior and response to cathodic protection from zinc anodes have been studied on eight wire-rope materials during 790 days exposure in sea water at the NRL Marine Corrosion Research Laboratory, Key West, Florida. The titanium alloy 13V-11Cr-3Al, the nickel-base alloy, and the aluminized steel were inherently corrosion resistant. Based solely on corrosion resistance, their use would be suitable for two years total immersion in sea water even without cathodic protection. Unprotected phosphor bronze, galvanized steel, and copper-nickel clad stainless steels are not suitable for extended use in sea water. Phosphor bronze and galvanized steel would be satisfactory for long-term service if cathodically protected. The 90/10 copper-nickel clad Type 304L stainless steel was essentially corrosion free when cathodically protected. Pitting was not eliminated on unclad Type 304L stainless steel even when cathodically protected. The 90/10 copper-nickel clad Type 205 stainless steel showed localized corrosion on some of the wires when cathodically protected with a zinc anode. (Modified author abstract) GRA

N74-15197# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
THE VAPOR PRESSURE AND HEATS OF VAPORIZATON OF NICKEL Technical Report, Sep. 1970 - Sep. 1972
Emile Rutner and Gerald L. Haury May 1973 86 p refs
(AF Proj. 7360)
(AD-768332; AFML-TR-72-217) Avail: NTIS CSCL 07/4

The Langmuir technique for determining vapor pressure was used to determine the vapor pressure of nickel between 1233 and 1683K. The vapor pressure data thus obtained was combined with other available data in the literature to obtain a best value for the heat of vaporization of nickel solid and liquid. Equations for the vapor pressure of nickel in these temperature ranges were also determined. The data in the literature used to determine heats of dissociation of the NiO and Ni2 gaseous molecules was corrected, and revised heats of dissociation of Ni2 and NiO gaseous molecules were obtained, as well as estimates for heat of vaporization of NiO solid. The literature on ionization cross sections useful in mass spectrometry was examined, and best values of the ionization cross sections of silver, lead, and nickel were determined. GRA

N74-15198# California Univ., Los Angeles. School of Engineering and Applied Science.
THE CRITICAL CRACK-TIP OPENING DISPLACEMENT AND MICROSCOPIC AND MACROSCOPIC FRACTURE CRITERIA FOR METALS
John N. Robinson and Alan S. Tetelman Aug. 1973 232 p refs
(Contract DAHC04-69-C-0008)
(AD-768926; UCLA-ENG-7360; AROD-8016-10-MC; TR-11) Avail: NTIS CSCL 11/6

The critical plane strain stress intensity factor (Klc), when combined with nondestructive testing, can be related to the fracture stress of a structure and has gained acceptance for the design of certain critical systems. Presently accepted methods of measuring Klc are, however, difficult and expensive to use for all but low toughness, high strength materials. The major objective of this investigation has been the development of a fracture criterion which can be related to the load-bearing capability of a structure yet is easily measurable using small inexpensive specimens, even for tough, low-strength materials. Because of its potential as a fracture criterion for fracture beyond general yield, particular emphasis has been placed on the measurement of on-load crack tip opening displacement, COD. Special significance has been placed on measuring critical values of plane strain COD at fracture initiation, (COD)Ic. (Modified author abstract) GRA

N74-15199# British Steel Corp., London (England).
SELECTION AND MONITORING OF ATMOSPHERIC EXPOSURE SITES FOR CORROSION TESTS
J. F. Stanners Aug. 1973 12 p refs
(PB-223683/4GA; BISRA-CEL/CH/13/70) Avail: NTIS HC $3.00 CSCL 11F

The choice of natural atmospheres for corrosion tests is influenced by practical factors, including accessibility, security of tenure, cost, and freedom from vandalism. But these must not be allowed to outweight the technological and scientific requirements, which are discussed in detail. The variables influencing corrosion or breakdown rates under service conditions must be recognized and the one that predominates in its influence identified. Sulphur pollution, chloride from the sea, pH of rain, metal temperature, time-of-wetness, and solar radiation are discussed. A system is proposed for keeping the number of sites to a minimum. GRA

N74-15200# British Steel Corp., London (England). Strip Mills Div.
A REVIEW OF RECENT OBSERVATIONS ON THE DEFORMED, RECOVERED AND RECRYSTALLISED STATES IN IRON AND LOW CARBON FERRITIC STEELS
Cuppam Dasarathy Aug. 1973 41 p refs
(PB-223687/5GA; BISRA-SM/668/A) Avail: NTIS HC $4.25 CSCL 11F

The review is based on an invited lecture series delivered at certain metallurgical institutions in India during September, 1972. Over the past decade, major observations have been made on several important aspects of the deformed, recovered and recrystallized states in pure iron and low carbon steels. The salient features of these observations are reviewed in the present document under three main sections, the deformed state, the recovered state and the recrystallized state. Although the review deals essentially with low carbon ferritic steels, related observations on pure iron are also included wherever considered appropriate. The review is supported by eighty-four literature references. GRA

N74-15201# British Steel Corp., London (England).
DEVELOPMENT OF ARGON ARC MELTING TECHNIQUES FOR THE PREPARATION OF SOLID SPECIMENS FOR INSTRUMENTAL ANALYSIS FROM DRILLINGS
H. Hughes Aug. 1973 13 p refs
(PB-223684/2GA; BISRA-GS/TECH/251/1/73/C) Avail: NTIS HC $3.00 CSCL 11F

A technique was developed for the preparation of solid samples for instrumental analysis from drillings, millings or turnings, using an argon arc remelting furnace. Comparative analyses were carried out on cast buttons prepared in the furnace and the parent solids from which the buttons originated. Both optical emission and X-ray fluorescence were used to determine Si, Mn, P, S, Cr, Mo, Ni, Cu, Nb, Sn, Ti, V, and Zr in the samples. Comparative analyses were also made for C, Al and B using optical emission only. The results indicate that the remelting technique can be used with confidence for the determination of all these elements in steel with the exception of Zr. Losses (and apparent gains) do occur in certain cases but these are reproducible and can be corrected for in calibration. GRA

N74-15202# McDonnell Aircraft Co., St. Louis, Mo.
EVALUATION OF THE RELIABILITY AND SENSITIVITY OF NDT METHODS FOR TITANIUM ALLOYS Annual Report, 1 May 1972 - 28 Feb. 1973
Robert J. Lord Mar. 1973 110 p refs
(Contract F33615-72-C-1203; AF Proj. 7351)
(AD-768627; AFML-TR-73-107) Avail: NTIS CSCL 11/6

The report describes the work conducted on a program designed to improve nondestructive testing techniques and, then, to evaluate the capability and reproducibility of the improved nondestructive testing techniques for the evaluation of discontinuities occurring in titanium. Reported are penetrant dwell times, penetrant bleed-out times, developer types, emulsification times, and water washing parameters required to effectively penetrant inspect parts which may contain a variety of crack sizes and porosity. Both post-emulsifiable and water washable fluorescent penetrants were investigated. A full scale Ti-6Al-4V ingot was melted in a manner to intentionally produce stabilized alpha defects. Documented are the details of the ingot melting and conversion to billet, bar, and plate. Results of ultrasonic and radiographic inspections of the ingot and billets are reported.
Author (GRA)

N74-15203# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE BEHAVIOR OF TITANIUM BASE ALLOYS IN THE AGGRESSIVE MEDIA OF SYNTHETIC RESIN PRODUCTION
S. L. Lelchuk and G. K. Grell 16 Oct. 1973 6 p Transl. into ENGLISH from Novyi Konstruktsionny Mater. (Titan), 1972 p 192-193
(FTD Proj. 60107; FTD Proj. T74-01-10)
(AD-769046; FTD-HT-23-157-74) Avail: NTIS CSCL 11/6

An alloy of titanium with 32% Mo was tested for corrosion resistance under production conditions for synthesizing bisphenol A. The resultant data show that it is corrosion resistant and can be used as a structural material for the reactor in the production of bisphenol A. Titanium alloy with 32% Mo and titanium with 5% Ta were tested under experimental conditions for synthesizinG VBFS-4 resin. Both alloys were corrosion resistant and can also be used as structural materials in the production of VBFS-4 resin. GRA

N74-15204# Kaiser Aluminum and Chemical Corp., Pleasanton, Calif. Center for Technology.
VACUUM TREATMENT OF PREALLOYED ALUMINUM POWDERS AT MODERATE TEMPERATURES Final Report, 1 Jan. - 31 Jul. 1973
S. G. Roberts Oct. 1973 44 p refs
(Contract DAAG46-73-C-0040; DA Proj. 1W5-64603-D-663)
(AD-769074; AMMRC-CTR-73-33) Avail: NTIS CSCL 11/6

The objective was to determine if treating coarse, highly alloyed aluminum powder (Al-Zn-Mg-Cu plus Co or Zr) at moderate temperatures under relatively high vacuum would yield ductile wrought alloys at strength levels of 100 ksi. Canned, green compacts of -100-325 mesh power were heated at 600F and 700F; evacuated sealed hot compacted, decanned and extruded at a 8.5:1 ratio into 1.5-in. diameter rod. Longitudinally the extrusions were strong and ductile. The transverse ductility was poor due to insufficient deformation during extrusion and porosity not eliminated by the vacuum treatment. It is expected that further study of the process variables would yield the techniques required to obtain high transverse strength and ductility. (Modified author abstract) GRA

N74-15205# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE INVESTIGATION OF THE PARAMETERS OF GAS JETS FOR THE ATOMIZATION OF MELTS
I. P. Goldaev, A. P. Motornenko, A. P. Shevchenko, and Yu. A. Lastivnyak 11 Oct. 1973 14 p refs Transl. into ENGLISH from Samoletostr. Tekh. Vozdush. Flota (USSR), no. 25, 1971 p 15-21
(AD-769047; FTD-HT-23-173-74) Avail: NTIS CSCL 11/6

The use of supersonic high temperature gas jets for the atomization of liquid metals and melts is promising since it permits one to change the parameters of the working medium in a wide range and thereby obtain powders with prescribed properties. In order to investigate the basic factors which affect the gas jet parameters with the aid thermodynamic calculations the basic theoretical relationships of the gas temperatures in the combustion chamber, the density at nozzle section and the dynamic viscosity are established as functions of the pressure in the combustion chamber and the excess air ratio. GRA

N74-15206# California Univ., Los Angeles. School of Engineering and Applied Science.
NEW METHODS OF SYNTHESIS OF MATERIALS. 1: THE PROPERTIES OF RARE EARTH METALS AND ALLOYS, 2 Semiannual Technical Report
R. F. Bunshah and D. L. Douglas Sep. 1973 104 p refs
(Contract DAHC15-70-G-0015; ARPA Order 1643)
(AD-768794; UCLA-ENG-7374; SATR-6) Avail: NTIS CSCL 11/6

The report describes: Preparation of Nickel foil by high rate physical vapor deposition techniques and evaluation of its properties. Experiments on high rate deposition of Y2O3, TiC, Si3N4 by direct evaporation and of Y2O3 and Si3N4 by reactive evaporation and activated reactive evaporation; and The oxidation behavior of Ni3Al and Ni3Al-0.5Y at 1200C. GRA

N74-15224 Geological Survey, Washington, D.C.
BERYLLIUM
Wallace R. Griffitts *In its* US Mineral Resources 1973 p 85-93 refs (For availability see N74-15214 06-18)

N74-15225 Geological Survey, Washington, D.C.
BISMUTH
J. W. Hasler, M. H. Miller, and R. M. Chapman *In its* US Mineral Resources 1973 p 95-98 refs (For availability see N74-15214 06-18)

N74-15227 Geological Survey, Washington, D.C.
CADMIUM
Helmuth Wedow, Jr. *In its* US Mineral Resources 1973 p 105-110 refs (For availability see N74-15214 06-18)

N74-15228 Geological Survey, Washington, D.C.
CHROMIUM
T. P. Thayer *In its* US Mineral Resources 1973 p 111-122 refs (For availability see N74-15214 06-18)

N74-15233 Geological Survey, Washington, D.C.
COPPER
Dennis P. Cox, Robert G. Schmidt, James D. Vine, Harold Kirkemo, Elizabeth B. Tourtelot, and Michael Fleischer *In its* US Mineral Resources 1973 p 163-190 refs (For availability see N74-15214 06-18)

N74-15238 Geological Survey, Washington, D.C.
GALLIUM, GERMANIUM, AND INDIUM
Robert A. Weeks *In its* US Mineral Resources 1973 p 237-246 refs (For availability see N74-15214 06-18)

N74-15241 Geological Survey, Washington, D.C.
GOLD
Frank S. Simons and C. Prinz William *In its* US Mineral Resources 1973 p 263-275 refs (For availability see N74-15214 06-18)

N74-15244 Geological Survey, Washington, D.C.
IRON
Harry Klemic, Harold L. James, and G. Donald Eberlein *In its* US Mineral Resources 1973 p 291-306 refs (For availability see N74-15214 06-18)

N74-15246 Geological Survey, Washington, D.C.
LEAD
H. T. Morris, Allen V. Heyl, and Robert B. Hall *In its* US Mineral Resources 1973 p 313-332 refs (For availability see N74-15214 06-18)

N74-15249 Geological Survey, Washington, D.C.
LITHIUM, CESIUM, AND RUBIDIUM: THE RARE ALKALI METALS
James J. Norton *In its* US Mineral Resources 1973 p 365-378 refs (For availability see N74-15214 06-18)

N74-15251 Geological Survey, Washington, D.C.
MANGANESE
John Van H. Dorr, II, Max D. Crittenden, Jr., and Ronald G. Worl *In its* US Mineral Resources 1973 p 385-399 refs (For availability see N74-15214 06-18)

N74-15252 Geological Survey, Washington, D.C.
MERCURY
E. H. Bailey, A. L. Clark, and R. M. Smith *In its* US Mineral Resources 1973 p 401-414 refs (For availability see N74-15214 06-18)

N74-15253 Geological Survey, Washington, D.C.
MICA
Frank G. Lesure *In its* US Mineral Resources 1973 p 415-423 refs (For availability see N74-15214 06-18)

N74-15254 Geological Survey, Washington, D.C.
MOLYBDENUM
R. U. King, D. R. Shawe, and E. M. MacKevett, Jr. *In its* US Mineral Resources 1973 p 425-435 refs (For availability see N74-15214 06-18)

N74-15255 Geological Survey, Washington, D.C.
NICKEL
Henry R. Cornwall *In its* US Mineral Resources 1973 p 437-442 refs (For availability see N74-15214 06-18)

N74-15256 Geological Survey, Washington, D.C.
NIOBIUM (COLUMBIUM) AND TANTALUM
Raymond L. Parker and John W. Adams *In its* US Mineral Resources 1973 p 443-454 refs (For availability see N74-15214 06-18)

N74-15257 Geological Survey, Washington, D.C.
NUCLEAR FUELS: URANIUM
Warren I. Finch, Arthur P. Butler, Jr., Frank C. Armstong, and Albert E. Weissenborn *In its* US Mineral Resources 1973 p 456-468 refs (For availability see N74-15214 06-18)

N74-15258 Geological Survey, Washington, D.C.
NUCLEAR FUELS: THORIUM
Mortimer H. Staatz and Jerry C. Olson *In its* US Mineral Resources 1973 p 468-476 refs (For availability see N74-15214 06-18)

N74-15264 Geological Survey, Washington, D.C.
PLATINUM-GROUP METALS
Norman J. Page, Alien L. Clark, George A. Desborough, and Raymond L. Parker *In its* US Mineral Resources 1973 p 537-545 refs (For availability see N74-15214 06-18)

N74-15266 Geological Survey, Washington, D.C.
RHENIUM
R. U. King *In its* US Mineral Resources 1973 p 557-559 refs (For availability see N74-15214 06-18)

N74-15268 Geological Survey, Washington, D.C.
SCANDIUM
John W. Adams *In its* US Mineral Resources 1973 p 567-571 refs (For availability see N74-15214 06-18)

N74-15271 Geological Survey, Washington, D.C.
SILVER
Allen V. Heyl, W. E. Hall, Albert E. Weissenborn, H. K. Stager, W. P. Puffett, and Bruce L. Reed *In its* US Mineral Resources 1973 p 581-603 refs (For availability see N74-15214 06-18)

N74-15274 Geological Survey, Washington, D.C.
TELLURIUM
D. F. Davidson and H. W. Lakin *In its* US Mineral Resources 1973 p 627-630 refs (For availability see N74-15214 06-18)

N74-15275 Geological Survey, Washington, D.C.
THALLIUM
Keith Robinson *In its* US Mineral Resources 1973 p 631-636 refs (For availability see N74-15214 06-18)

N74-15276 Geological Survey, Washington, D.C.
TIN
C. L. Sainsbury and Bruce L. Reed *In its* US Mineral Resources 1973 p 637 refs (For availability see N74-15214 06-18)

N74-15277 Geological Survey, Washington, D.C.
TITANIUM
Harry Klemic, Sherman P. Marsh, and Margaret Cooper *In its* US Mineral Resources 1973 p 653-665 refs (For availability see N74-15214 06-18)

N74-15278 Geological Survey, Washington, D.C.
TUNGSTEN
S. Warren Hobbs and James E. Elliott *In its* US Mineral Resources 1973 p 667-678 refs (For availability see N74-15214 06-18)

N74-15279 Geological Survey, Washington, D.C.
VANADIUM
R. P. Fischer *In its* US Mineral Resources 1973 p 679-688 refs (For availability see N74-15214 06-18)

N74-15281 Geological Survey, Washington, D.C.
ZINC
Helmuth Wedow, Jr., Thor H. Kiilsgaard, Allen V. Heyl, and Robert B. Hall *In its* US Mineral Resources 1973 p 697-711 refs (For availability see N74-15214 06-18)

N74-15282 Geological Survey, Washington, D.C.
ZIRCONIUM AND HAFNIUM
Harry Klemic, David Gottfried, Margaret Cooper, and Sherman P. Marsh *In its* US Mineral Resources 1973 p 713-722 refs (For availability see N74-15214 06-18)

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N74-15207 British Library Lending Div., Boston Spa (England).
STRESS LIMITS FOR SINTERED CARBIDES
J. Hinnuber 5 Jul. 1973 10 p refs Transl. into ENGLISH from Tech. Mitt. Krupp (West Germany), v. 13, no. 3, 1955 p 66-68 In ENGLISH and GERMAN Presented at 7th Aachen Machine-Tool Colloq., 10 Jun. 1954
(BLL-LTI-746-1447-(9022.401)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

The properties of sintered carbides at elevated temperatures are discussed with emphasis on alloys for cutting steels. The cutting temperatures, chemical behavior at the cutting temperature, and principles for economic utilization are also discussed.
F.O.S.

N74-15208# National Aeronautical Lab., Bangalore (India).
EFFECT OF PLASTIC DEFORMATION ON THE AGE-HARDENING OF AlCuMg 1, AlCuMg 2 AND AlZnMgCu 0.5
Y. Takeuchi Oct. 1973 33 p refs Transl. into ENGLISH of "Einflue einer Plastischen Verformung auf das Kaltaushaertungsverhalten von AlCuMg 1, AlCuMg 2 and AlZnMgCu 0.5", West German report DLR-RB-71-91, 1971
(NAL-TR-188; DLR-FB-71-91) Avail: NTIS HC $3.75

The age hardening of three aluminum alloys under extension

loading both in the elastic and plastic range is reported. In particular, the effects of plastic deformation on the initial stage of zone formation is dealt with. Author

N74-15209*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SLIDING OF POLY(VINYL CHLORIDE) ON METALS STUDIED BY AUGER ELECTRON SPECTROSCOPY
Stephen V. Pepper Washington Jan. 1974 24 p refs
(NASA-TN-D-7533; E-7469) Avail: NTIS HC $2.75 CSCL 11D

The sliding of polyvinyl chloride on nickel, iron and S-Monel has been studied by Auger electron spectroscopy. Polymer was not transferred to the metals, rather shear appeared to take place at the interface. The metal was progressively chlorinated as the polymer made multiple passes on the surface. The thickness of this chlorine film was the order of one atomic layer. Electron-induced desorption studies indicate that the chlorine is chemisorbed to the metal. These results are interpreted as evidence for mechanically induced and/or thermal degradation of the polymer during sliding. Degradation products of HCl and Cl2 which chemisorb to the metal are evolved near the interface. Author

N74-15210*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PREPARATION AND EVALUATION OF THIN-FILM SODIUM TUNGSTEN BRONZES
Harold E. Kautz, William L. Fielder, Joseph Singer, and J. Stuart Fordyce Washington Jan. 1974 13 p refs
(NASA-TM-X-2985; E-7668) Avail: NTIS HC $2.75 CSCL 11D

Thin films of sodium tungsten bronze (NaxWO3) were investigated as reversible sodium ion electrodes for solid electrolytes. The films were made by electron beam evaporation of the three phases, W metal, Na2WO4, and WO3, followed by sintering. The substrates were sodium beta alumina disks and glass slides. X-ray diffraction analyses of the films showed that sintering in dry nitrogen with prior exposure to air lead to mixed phases. Sintering in vacuum with no air exposure produced tetragonal I bronze with a nominal composition of Na0.31WO3, single phase within the limits of X-ray diffraction detectability. The films were uniform and adherent on sodium beta alumina substrates. The ac and dc conductivities of the beta alumina were measured with the sodium tungsten bronze films as electrodes. These experiments indicated that the tetragonal I bronze electrodes were not completely reversible. This may have resulted from sodium ion blocking within the bronze film or at the bronze beta alumina interface. Methods for attempting to make more completely reversible electrodes are suggested. Author

N74-15211*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF CHROMIA DOPING OF THERMAL STABILITY OF SILICA FIBERS
Isidor Zaplatynsky Washington Jan. 1974 19 p refs
(NASA-TM-X-2969; E-7619) Avail: NTIS HC $2.75 CSCL 11D

Commercial silica fibers of the type being evaluated for reusable surface insulation for reentry vehicles were found to be porous and composed of subfibers. The effect on shrinkage and devitrification of soaking such silica fibers in water, acetic acid, chromium acetate, and chromium nitrate solutions was studied. Felted specimens made of chromia-doped fibers shrunk only about one-half as much as those made of untreated fibers after exposure in air for 4 hours at 1300 C. The devitrification rate of fibers given prolonged soaks in chromium nitrate was as low as that of as-received fibers. Author

N74-15212*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FORMULATION PROCEDURES, RATIONALE, AND PRELIMINARY IMP-H FLIGHT DATA FOR SILICONE PAINTS WITH IMPROVED STABILITY
John B. Schutt and Charles M. Shai Dec. 1973 39 p refs
(NASA-TM-X-70560; X-764-73-373) Avail: NTIS HC $4.00 CSCL 11C

Results are given of a class of silicone paints undergoing space qualification on IMP-H. In addition to ultraviolet irradiation, samples are presently reclining about 10 to the 16th power solar wind protons per year. Preliminary data, covering the time span of the first anniversary, give incremental solar absorptances of 0.03 for two white paints, and 0.01 for leafing aluminum and a green tinted white paint. Complementing these data are complete descriptions of techniques used in making these paints, stabilizing the zinc oxide pigment, and choosing a solvent. Outgassing characteristics of finished coatings are also included. An attempt toward unification of these various aspects of the aerospace paint problem is provided through documented photochemical reactions, and a generalized band representation of the problem and its solutions. Author

N74-15213*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
STRAIN ARRESTOR PLATE Patent Application
Murat H. Kural, inventor (to NASA) Filed 28 Nov. 1973 15 p
(Contract NAS9-12083)
(NASA-Case-MSC-14182-1; US-Patent-Appl-SN-419748) Avail: NTIS HC $3.00 CSCL 11D

An improved technique of attaching rigid thermal insulator tiles to metallic sub-panels or structural members on the exposed surfaces of spacecraft or other frameworks is described. Heretofore this has been done by a flexible bond, but it has been found that at temperatures below the glass transition range such bonds lose their flexibility and transfer more strains to the insulator tiles. The problem is solved by incorporation of a strain arrestor plate adjacent to the insulator tile and secured with an adhesive which may be either a flexible bond or a hard bond. Since most rigid thermal insulators are made of low expansion materials, Invar may be used for the plate, where weight is not a problem, but the preferred material is the lighter weight combination of fibers cast in a thermosetting resin. The preferred material is graphite fibers in an epoxy resin, built up in layers with various fiber orientations to obtain the desired strength, stiffness and thermal properties. NASA

N74-15214# Geological Survey, Washington, D.C.
UNITED STATES MINERAL RESOURCES
Donald A. Brobst, ed. and Walden P. Pratt, ed. 1973 722 p refs
(USGS-PP-820; LC-73-600060) Avail: SOD HC $9.15 Domestic Postpaid or $8.50 GPO Bookstore

Exploration and management of mineral sources are assessed for the U.S. potential in comparison with worldwide deposits. For individual titles, see N74-15215 through N74-15282.

N74-15215 Geological Survey, Washington, D.C.
INTRODUCTION
Donald A. Brobst and Walden P. Pratt *In its* US Mineral Resources 1973 p 1-8 refs (For availability see N74-15214 06-18)

The importance of minerals or mineral products to our present industrial civilization and standard of living is discussed and a distinction between mineral resources and reserves is elaborated. The increasing importance of large volumes of low grade rocks and attendant environmental problems, mineral byproduct utilization, energy extraction from minerals, and future research in all aspects of mineral resources are discussed. G.G.

N74-15216 Geological Survey, Washington, D.C.
MINERAL RESOURCE ESTIMATES AND PUBLIC POLICY
V. E. McKelvey *In its* US Mineral Resources 1973 p 9-19 refs (For availability see N74-15214 06-18)

Comprehensive mineral resource estimates are essential for critical examinations of resource adequacy and management. Appraisals of potential mineral resources and their utilizations consider the magnitude of mineral deposits, production costs, definitions of inferred mineral reserves, feasibility of recovery aspects and industrial processing methods. G.G.

N74-15217 Geological Survey, Washington, D.C.
CRUSTAL ABUNDANCE OF ELEMENTS, AND MINERAL RESERVES AND RESOURCES
Ralph L. Erickson *In its* US Mineral Resources 1973 p 21-25 refs (For availability see N74-15214 06-18)

Crustal abundance data and the reserve-abundance relationship of McKelvey are combined to calculate the total amounts of several metals in the earth's crust, in various segments of the crust, in United States crust, in United States crust to a 1-kilometer depth, and in the potential currently recoverable resources. The potential recoverable resource for most elements should approach R=2.45AX1million, where A is abundance expressed in grams per metric ton or parts per million and R is resource expressed in metric tons. Those metals whose known reserves most closely approach the calculated potential recoverable resource are lead, copper, zinc, silver, gold, molybdenum. Those metals whose known reserves are very much less than the calculated potential recoverable resource (nickel, tin) are the metals usually found in geologic environments not common in the United States. Author

N74-15218 Geological Survey, Washington, D.C.
ABRASIVES
Robert E. Thaden *In its* US Mineral Resources 1973 p 27-33 refs (For availability see N74-15214 06-18)

The principal natural abrasives are diamond, corundum, emery, garnet, tripoli, and silica sand, and the United States is fortunate to have identified resources of most of them which will serve as supply at current rates of consumption for from 50 years to more than 100,000 years. Artificial abrasives, principally aluminum oxide, silicon carbide, and steel shot and grit, manufactured from abundant raw materials, have supplanted natural abrasives in about 90 percent of all critical applications and, together with artificial diamond, encroach on the few remaining uses for which the natural abrasives in shortest supply once were thought uniquely qualified. Author

N74-15219 Geological Survey, Washington, D.C.
ALUMINUM AND BAUXITE
Sam H. Patterson and John R. Dyni *In its* US Mineral Resources 1973 p 35-43 refs (For availability see N74-15214 06-18)

Imports of bauxite and alumina supply approximately 87 percent of the United States requirements for manufacture of aluminum metal and certain refractories, abrasives, and chemicals. Bauxite mined in Arkansas, Georgia, and Alabama supplies the remaining 13 percent. The growing requirements of the aluminum industry will be met by imports of increasing amounts of aluminum metal and alumina rather than bauxite ore. Domestic sources of bauxite are inadequate to fulfill long term demands; however, virtually inexhaustable potential resources of high alumina clays seem most promising as potential alternate sources. Dawsonite in rich oil shale deposits, and alunite may by possible aluminum sources. Less promising potential resources include aluminous shale and slate, aluminum phosphate rock, igneous rocks, saprolite, coal ash, and copper leach solutions. Author

N74-15220 Geological Survey, Washington, D.C.
ANTIMONY
M. H. Miller *In its* US Mineral Resources 1973 p 45-50 refs (For availability see N74-15214 06-18)

The United States consumes each year about 40 percent of the world's supply of primary antimony. Deposits in this country furnish only about 15 percent of the antimony consumed, and most of this is recovered as a byproduct from silver, copper, and lead-zinc ores, mainly in Idaho, and as antimonial lead from lead smelters. Identified resources in the United States, estimated to be 100,000 short tons, are in Idaho, Nevada, Alaska, and Montana. Future antimony resources may be developed from Mississippi Valley-type lead deposits and from certain base metal deposits in the eastern United States. The possibility of future production from these sources will hinge on the ability of lead smelters to continue operations and meet standards set to protect the environment. Author

N74-15221 Geological Survey, Washington, D.C.
ARSENIC
J. L. Gualtieri *In its* US Mineral Resources 1973 p 51-61 refs (For availability see N74-15214 06-18)

Arsenic is produced as a byproduct and occurs in several types of deposits: enargite bearing copper-zinc-lead deposits, arsenical pyritic copper deposits, native silver and nickel-cobalt arsenide deposits, arsenical gold deposits, arsenic sulfide and arsenic sulfide gold deposits, and arsenical tin deposits. U.S. and world identified resources of arsenic are herein estimated to be 1,300,000 short tons and 17,600,000 short tons, respectively; these resources are more than sufficient to fill projected needs until the year 2000. Hypothetical resources for the United States and the world are estimated at 650,000 short tons and 14,300,000 short tons, respectively. Arsenic can be obtainable from organic shale of marine origin. Author

N74-15222 Geological Survey, Washington, D.C.
ASBESTOS
Andrew F. Shride *In its* US Mineral Resources 1973 p 63-73 refs (For availability see N74-15214 06-18)

The United States is the principal fabricator and consumer of asbestos products and currently imports 85 percent of the raw asbestos needed to sustain its large industry. Chrysotile asbestos constitutes 93 percent of world asbestos trade, and Canada has been the principal supplier. Crocidolite and amosite make up about 3 1/2 and 2 1/2 percent, respectively, of world asbestos commerce; anthophyllite, tremolite, and actinolite apparently make up only a fraction of 1 percent. The only source of amosite is in the Transvaal. Domestic resources of anthophyllite and tremolite are apparently adequate for U.S. needs. Author

N74-15223 Geological Survey, Washington, D.C.
BARITE
Donald A. Brobst *In its* US Mineral Resources 1973 p 75-84 refs (For availability see N74-15214 06-18)

Three major types of barite deposits are vein and cavity-filling, residual, and bedded deposits. Residual deposits at shallow depths constitute a large resource in the United States. Bedded deposits of fetid black fine grained barite are abundant in siliceous sedimentary rocks of mid-Paleozoic age. The bedded deposits, probably of sedimentary origin, are a large deposits probably lie undiscovered in many parts of the world. The total of the world's barite resources in all categories is about 2 billion metric tons of barite, but only about 300 million metric tons (15 percent) are identified resources, which are the sum of currently minable ore (reserves) and lower grade material of subeconomic value now (conditional resources). Author

N74-15224 Geological Survey, Washington, D.C.
BERYLLIUM **c17**
Wallace R. Griffitts *In its* US Mineral Resources 1973 p 85-93 refs (For availability see N74-15214 06-18)

Beryllium metal is used in a variety of products in which its low density and other physical properties are particularly valuable. More than half the metal produced is used with copper in strong, fatigue resistant alloys. Beryllium oxide and beryl are used in many ceramic and other products. About 95 percent of the beryllium ore used in the United States has been imported. Significant domestic production began in 1969 and probably will increase until it accounts for at least half the ore consumed. The resources of beryllium in known domestic deposits are estimated at 60,000 tons, and these can be increased by further exploration to become sufficient to supply our needs for many decades. Author

N74-15225 Geological Survey, Washington, D.C.
BISMUTH **c17**
J. W. Hasler, M. H. Miller, and R. M. Chapman *In its* US Mineral Resources 1973 p 95-98 refs (For availability see N74-15214 06-18)

In the United States, bismuth is largely a byproduct from ores of other metals with which it is associated, principally lead and copper. Lesser amounts of bismuth are found in molybdenum, gold, silver, tin, tungsten, and zinc ores. The United States consumes annually as much as four times the amount of bismuth recovered from domestic ores; thus, the United States must rely on imports for 50-75 percent of its supply. The three principal uses of bismuth in the United States at present are in the manufacture of pharmaceuticals, low melting alloys, and metallurgical additives. Author

N74-15226 Geological Survey, Washington, D.C.
BITUMEN-BEARING ROCKS
W. B. Cashion *In its* US Mineral Resources 1973 p 99-104 refs (For availability see N74-15214 06-18)

Bitumen bearing rocks occur in many areas in the United

States, but few deposits have been exploited or evaluated for their total energy potential. The evaluated deposits are a relatively small part of North American resources of bitumen bearing rocks and probably will not contribute to U.S. energy needs before 1985. Studies of known but unappraised deposits, especially extensive subsurface tar sands, will greatly increase total resource estimates. Technological advancements are needed in tar sand processing, especially for in situ recovery methods. Author

N74-15227 Geological Survey, Washington, D.C.
CADMIUM **c17**
Helmuth Wedow, Jr. *In its* US Mineral Resources 1973 p 105-110 refs (For availability see N74-15214 06-18)

Cadmium is used chiefly in the electroplating of fabricated steel products to obtain superior corrosion resistance; additional uses are in the manufacture of yellow and red pigments, vinyl plastics, phosphors for television picture tubes, and nickel cadmium batteries. World recoverable and subeconomic resources are estimated to be in excess of 18 million metric tons of contained cadmium. About one-sixth of these resources is in deposits believed to be exploitable under existing economic conditions. Many of the deposits containing the world's cadmium resources are the conventional zinc bearing types, chiefly those known as massive sulfide and strata-bound. However, significant low grade resources occur in phosphorites and black metal rich shales. Author

N74-15228 Geological Survey, Washington, D.C.
CHROMIUM **c17**
T. P. Thayer *In its* US Mineral Resources 1973 p 111-122 refs (For availability see N74-15214 06-18)

Although world reserves are large and resources of chromite ore are ample for the foreseeable future, domestic resources are low grade and represent only about a 4- to 5-year supply. The outlook for substantially increasing domestic resources is not favorable. The thicker minable parts of the Stillwater Complex in Montana, the principal domestic source, are complexly faulted and sheared off at depth. A few relatively large podiform deposits probably are concealed at minable depths and might meet national needs for a few months at most. The principal North American resources other than those in the Stillwater Complex are in a similar complex in Manitoba and very large low-grade deposits in Greenland. Author

N74-15229 Geological Survey, Washington, D.C.
CLAYS
John W. Hosterman *In its* US Mineral Resources 1973 p 123-132 refs (For availability see N74-15214 06-18)

Clays are naturally occurring rocks composed of fine particles that are principally hydrous aluminum (or magnesium) silicates. Resources of clay deposits similar to those used currently are extremely large, except for those of high grade ball clay and high grade colloidal bentonite. The geologic profession could be of better service to the city, county, and State planners, the clay producers, and the consumers of a wide variety of clay products if geologists doing areal geologic mapping were more aware of the economic potential of clay occurrences in the area being mapped. Author

N74-15230 Geological Survey, Washington, D.C.
COAL
Paul Averitt *In its* US Mineral Resources 1973 p 133-142 refs (For availability see N74-15214 06-18)

World coal resources are estimated to total 16,830 billion tons, of which 9,500 billion tons is classed as identified, and 7,330 billion tons is classed as hypothetical. The United States contains about one-fifth of estimated total world resources. On a uniform Btu basis, U.S. coal resources are larger than the combined domestic resources of petroleum, natural gas, oil shale, and bituminous sandstone. The prolonged future need for energy in ever increasing quantities, and the prospect of decreasing availability of and increased prices for petroleum and natural gas, have focused very sharp attention on coal as an alternative source of synthetic gas, liquid fuels, and lubricants. Author

N74-15231 Geological Survey, Washington, D.C.
COBALT
John S. Vhay, Donald A. Brobst, and Allen V. Heyl *In its* US Mineral Resources 1973 p 143-155 refs (For availability see N74-15214 06-18)

Currently the United States consumes about 15 million pounds of the world's annual cobalt production of 45 million pounds, but the domestic production, only about 3 million pounds, is derived from recycled scrap and the byproduct of iron mining in Pennsylvania. That the amount of cobalt mined annually in the United States is so small is more a function of economic and technological problems than the lack of ore deposits containing cobalt. More than 1 billion pounds of cobalt are in identified resources of the United States, chiefly in various types of deposits of sulfide ore in the Appalachian and midcontinent regions. Author

N74-15232 Geological Survey, Washington, D.C.
CONSTRUCTION STONE
Robert A. Laurence *In its* US Mineral Resources 1973 p 157-162 refs (For availability see N74-15214 06-18)

Domestic resources of stone for construction, both crushed and dimension stone, are adequate to provide for the expected demand indefinitely. Resource problems exist in localities of urbanization and industrial development and will increase, unless careful plans are made to reserve favorable areas for quarrying. Geologic mapping, especially of urban and suburban areas, can provide basic data for such planning. Author

N74-15233 Geological Survey, Washington, D.C.
COPPER **c17**
Dennis P. Cox, Robert G. Schmidt, James D. Vine, Harold Kirkemo, Elizabeth B. Tourtelot, and Michael Fleischer *In its* US Mineral Resources 1973 p 163-190 refs (For availability see N74-15214 06-18)

A comparison of current U.S. and world production and the copper content of various copper deposits shows that the U.S. produces enough copper to mine out an average sized porphyric copper deposit each year. Maintaining a balance between copper deposits discovered and deposits mined out means that a great investment in geological, geochemical, and geophysical studies must be made and maintained. It is speculated that large sedimentary copper deposits will probably be found in the northern Rocky Mountains of the U.S. Author

N74-15234 Geological Survey, Washington, D.C.
DIATOMITE
David L. Durham *In its* US Mineral Resources 1973 p 191-196 refs (For availability see N74-15214 06-18)

Diatomite is a rock made of microscopic porous shells of silica. Its principal domestic use is as a filtering material, for purifying water and various food processing and industrial fluids; other diverse uses include fillers, construction and insulating materials, and mild abrasives. United States and world resources of crude diatomite are adequate for the foreseeable future, but the need for diatomite near markets and for particular purposes encourages development of new sources for the material. Studies that relate the geologic setting and history of diatomite to the occurrence and properties of the rock can help locate important undeveloped deposits. Author

N74-15235 Geological Survey, Washington, D.C.
EVAPORITES AND BRINES
George I. Smith, Charles L. Jones, William C. Culbertson, George E. Ericksen, and John R. Dyni *In its* US Mineral Resources 1973 p 197-216 refs (For availability see N74-15214 06-18)

Evaporite resources of the United States are large. Unlimited supplies of nitrates, bromine, and magnesium are available from air and sea water. Resources of salt and sodium carbonate appear adequate for thousands of years at present consumption rates. Known supplies of gypsum and anhydrite, sodium sulfate, borates, strontium, iodine, and calcium chloride should be adequate for hundreds of years. Known domestic resources of potassium compounds may be exhausted in 100 years at present consumption rates, but Canadian resources are sufficient to fulfill requirements of North America for thousands of years. Author

N74-15236 Geological Survey, Washington, D.C.
FELDSPAR
Frank G. Lesure *In its* US Mineral Resources 1973 p 217-222 refs (For availability see N74-15214 06-18)

Feldspar is the general name for an important group of aluminum silicate minerals used primarily in the glass and ceramic industries. Although consumption in the United States has more than doubled since 1940, domestic reserves and resources are considered adequate for anticipated demand. Transportation costs are a major factor in the delivered price of feldspar and contribute to the use of substitutes where available. Research problems involve identifying potential sources nearer to consumers. Demand for feldspar in the United States by the year 2000 is expected to be three to five times present production. This demand is in large part based on the increasing use of container glass and will depend partly on the recycling of bottle glass and the continued increase in the use of throwaway bottles. Author

N74-15237 Geological Survey, Washington, D.C.
FLUORINE
R. G. Worl, R. E. VanAlstine, and D. R. Shawe *In its* US Mineral Resources 1973 p 223-235 refs (For availability see N74-15214 06-18)

Fluorine is used by industry mainly as fluorspar (CaF2) for flux in steel making; as synthetic cryolite (Na3AlF6) and aluminum fluoride in the manufacture of aluminum metal; and as fluorocarbons in refrigerants, aerosol propellants, solvents, and many other compounds. The United States produces only 20 percent of its requirement at the present. Commercial sources of fluorine to data have been dominantly hydrothermal deposits of fluorspar. Additional sources in the future will be as byproducts from ores of other commodities, as coproducts of multicommodity ores, and from fluorine deposits other than hydrothermal. A major future source of fluorine will be as a byproduct of the processing of phosphate rock. Author

N74-15238 Geological Survey, Washington, D.C.
GALLIUM, GERMANIUM, AND INDIUM c17
Robert A. Weeks *In its* US Mineral Resources 1973 p 237-246 refs (For availability see N74-15214 06-18)

Known exploited sources of gallium, germanium, and indium are largely the ores of zinc and aluminum, from which they are recovered as minor byproducts. Potential additional sources are copper ores, tin ores, and combustion products of coal. The high cost of recovery and refining of gallium, germanium, and indium limits their use to relatively small quantities, mainly in transistors, diodes, and other electronic devices. The geologic potential for finding deposits that could be exploited solely for their gallium, germanium, or indium content is very small. The potential for discovery of ores of other metals from which gallium, germanium, or indium could be recovered is significant. The potential for recovery of gallium and germanium from coal ash, flue dust, and stack gases in industrial plants consuming large quantities of coal is large. Author

N74-15239 Geological Survey, Washington, D.C.
GEM STONES
Robert E. Thaden *In its* US Mineral Resources 1973 p 247-250 refs (For availability see N74-15214 06-18)

Gem stones are mineral substances, other than metals, that are attractive enough for use in personal adornment or as small household objects. Diamond, sapphire, ruby, and emerald generally are considered precious stones; all other gem stones generally are considered semi-precious. Neither imitation nor synthetic gems have infringed seriously on the market for natural stones, nor are they likely to do so. Gem stones occur in most of the major geologic environments, but they do not form ore deposits in the normal sense. Since 1935, the mining of gem stones in the United States has been almost entirely a recreational activity of mineral collectors and hobbyists. The annual value of such gem production has risen from half a million dollars in 1952 to nearly $3 million in 1972. Author

N74-15240 Geological Survey, Washington, D.C.
GEOTHERMAL RESOURCES c13
L. J. P. Muffler *In its* US Mineral Resources 1973 p 251-261 refs (For availability see N74-15214 06-18)

The geothermal resource base is defined as all the heat above 15 C in the earth's crust, but only a small part of this resource base can properly be considered as a resource. The magnitude of the geothermal resource depends on the evaluation of many physical, technological, economic, environmental, and governmental factors. The physical factors that control the distribution of heat at depth can be evaluated, at least rudely. More tenuous are the assumptions of technology, economics, and governmental policy. These assumptions are critical to geothermal resource estimation. Author

N74-15241 Geological Survey, Washington, D.C.
GOLD c17
Frank S. Simons and C. Prinz William *In its* US Mineral Resources 1973 p 263-275 refs (For availability see N74-15214 06-18)

Most of the world's gold reserves, estimated at 1 billion ounces, are in South Africa. The U.S.S.R. is thought to have a large part of the remainder, and no other country has more than a few percent of the reserves. United States nonmonetary consumption of gold has been three to four times domestic production for several years, and the United States is unlikely to become self-sufficient in gold in the foreseeable future. United States gold reserves of a few tens of millions of ounces are mainly in the Homestake (S. Dak.) and Carlin and Cortez (Nev.) gold deposits and in copper deposits which produce byproduct gold. U.S. gold resources are large but in general very low grade, and most placer deposits pose insurmountable technologic problems at present. Author

N74-15242 Geological Survey, Washington, D.C.
GRAPHITE
Paul L. Weis *In its* US Mineral Resources 1973 p 277-283 refs (For availability see N74-15214 06-18)

The identified, hypothetical, and speculative resources of graphite are reported. Commercial applications of graphite are discussed. The chemical, physical, and mechanical properties of graphite are described. Data are presented to show: (1) consumption of natural graphite in the United States in 1969, (2) tonnage and value of 1969 U.S. imports for consumption of natural graphite by countries, and (3) U.S. consumption of graphite from 1910 to 1969. The locations of major graphite deposits are identified. Author

N74-15243 Geological Survey, Washington, D.C.
HELIUM
Dwight E. Ward and Arthur P. Pierce *In its* US Mineral Resources 1973 p 285-290 refs (For availability see N74-15214 06-18)

The identified, hypothetical, and speculative resources of helium are reported. The applications of helium in space exploration, industry, and research are discussed. The chemical and physical properties of helium are described. Data are presented to show: (1) helium sales in the United States from 1920 to 1970 and (2) some known deposits of helium in the United States and Canada. Author

N74-15244 Geological Survey, Washington, D.C.
IRON c17
Harry Klemic, Harold L. James, and G. Donald Eberlein *In its* US Mineral Resources 1973 p 291-306 refs (For availability see N74-15214 06-18)

The identified, hypothetical, and speculative resources of iron are reported. The byproducts and coproducts of iron are described. The geologic environment is analyzed to show the types of iron deposits and quantities. Data are presented to show: (1) U.S. iron ore consumption, production and imports for consumption during the period 1951 to 1971, (2) sources and amounts of iron ore imported to the United States from 1961 to 1971, (3) the value of U.S. imports and exports of iron ore from 1951 to 1971, and (4) iron ore production in the U.S. from 1875 to 1971. Actions for locating additional iron deposits and methods for reducing the environmental impact of iron ore mining are proposed. Author

N74-15245 Geological Survey, Washington, D.C.
KYANITE AND RELATED MINERALS
Gilbert H. Espenshade *In its* US Mineral Resources 1973 p 307-312 refs (For availability see N74-15214 06-18)

Kyanite and related minerals are high-alumina silicates used mainly in the manufacture of refractory linings for metallurgical and other types of furnaces. Domestic production currently exceeds consumption, and considerable tonnages are exported. Enormous resources of these minerals exist in the United States; this should permit the increase in production that will be needed to meet

the demand expected during the next 25 years. Production now comes largely from kyanite-quartz deposits in the Southeastern States; kyanite and sillimanite are also recovered as a byproduct from Florida ilmenite sands. Resources of deposits of these two types are very large but make up no more than 5 percent of our total resources. The remaining 95 percent or more is in deposits of micaceous schist and gneiss, mostly in the Appalachian Mountain system and in Idaho. None of these deposits is now being mined, but profitable mining of some may eventually be possible. Author

N74-15246 Geological Survey, Washington, D.C.
LEAD c17
H. T. Morris, Allen V. Heyl, and Robert B. Hall *In its* US Mineral Resources 1973 p 313-332 refs (For availability see N74-15214 06-18)

The conditional, hypothetical, and speculative resources of lead are reported. The geologic environment of lead is discussed to show the geochemistry, ore mineralogy, and types of deposits. The physical, mechanical, and chemical properties of lead are described. The commerical applications of lead are shown. Data are presented for: (1) production of primary lead in the U.S. from 1830 to 1971, (2) consumption of lead in the U.S. from 1918 to 1971, (3) world mine production of lead in 1969 by countries, and (4) estimate of world reserves of lead by regions or countries. Author

N74-15247 Geological Survey, Washington, D.C.
LIGHTWEIGHT AGGREGATES
A. L. Bush *In its* US Mineral Resources 1973 p 333-355 refs (For availability see N74-15214 06-18)

The United States is adequately supplied with both structural lightweight aggregates (scoria, volcanic cinder, pumice and pumicite, expandable clays, shales and slates, diatomite, expanded blast furnace slag, and fly and bottom ash) and ultralightweight aggregates (expanded perlite, expanded pumicite, and exfoliated vermiculite). The aggregates are low unit value, high place value materials, partly because large quantities are available and partly because normal-weight (sand and gravel) and synthetic aggregates are stiff competition. However, they have high place value, in as much as transportation costs largely determine whether they are used. Recoverable reserves of expanded clays, shales, and slates are equivalent to about half the cumulative output needed through the year 2000. Author

N74-15248 Geological Survey, Washington, D.C.
LIMESTONE AND DOLOMITE
Harold A. Hubbard and George E. Ericksen *In its* US Mineral Resources 1973 p 357-364 refs (For availability see N74-15214 06-18)

Limestone and dolomite are at or near the earth's surface over at least 10 percent of the continental areas, and the resources are extremely large. However, high-purity stone suitable for chemical and metallurgical use is restricted in extent, but its resources are large, also. For uses in which physical properties of the rock are important, as in construction, many kinds of rock can be substituted for limestone and dolomite. For uses in which the chemical properties are important, substitutes are few, generally scarce, and more costly. The largest resources of high-purity limetone and dolomite in the United States are in the central and eastern parts of the country, but details of the distribution of such stone are incompletely known. Consequently, some potentially valuable deposits are endangered by urban spread and by zoning regulations that restrict or prevent quarrying in populous areas. Author

N74-15249 Geological Survey, Washington, D.C.
LITHIUM, CESIUM, AND RUBIDIUM: THE RARE ALKALI METALS c17
James J. Norton *In its* US Mineral Resources 1973 p 365-378 refs (For availability see N74-15214 06-18)

Lithium, cesium, and rubidium, though rare in comparison with sodium and potassium, are abundant relative to the apparent commercial need for them. Lithium and cesium both form independent minerals in pegmatites. Lithium production from brines has increased so greatly in recent years that it has taken much of the market away from pegmatitic lithium. Rubidium forms no known independent minerals but exists chiefly as a substitute for potassium, especially in minerals formed late in the crystallization of pegmatites. Most commercial rubidium and some cesium have been obtained as byproducts of processing lepidolite. The world's proved and probable reserves of lithium, most of which are in the United States, are 1,200,000 tons, or about 400 times the 1970 consumption. Additional resources in known lithium regions are about 10 million tons, and even this large figure probably could be increased many times by intensive search throughout the world. Author

N74-15250 Geological Survey, Washington, D.C.
MAGNESIAN REFRACTORIES
Alfred J. Bodenlos and T. P. Thayer *In its* US Mineral Resources 1973 p 379-384 refs (For availability see N74-15214 06-18)

Magnesium-bearing compounds are processed into high-temperature refractories, indispensable as linings in modern steel furnaces; chemicals; and magnesium, the lightest of structural metals. They are derived from minerals, brines, and sea water. Resources from which magnesium-bearing compounds may be recovered range in size from large to practically unlimited and are globally widespread. Identified resources of magnesite throughout the world total 12 billion tons, and those of brucite several million tons. Resources of dolomite, forsterite, and the magnesium-bearing evaporite minerals are enormous; magnesium-bearing brines must constitute a resource of billions of tons; and the resource contained in sea water is practically unlimited. The bulk of magnesium-bearing compounds and the metal are recovered in the United States from sea water, brines, and dolomite, and elsewhere in the world from magnesite. Author

N74-15251 Geological Survey, Washington, D.C.
MANGANESE c17
John Van H. Dorr, II, Max D. Crittenden, Jr., and Ronald G. Worl *In its* US Mineral Resources 1973 p 385-399 refs (For availability see N74-15214 06-18)

Known minable reserves and known resources of manganese are very large in relation to world consumption but are very irregularly distributed throughout the world. The United States has virtually no domestic reserves and its known resources are both very low grade and refractory to economic concentration. The principal hopes of finding domestic reserves or resources of conventional types may lie in (1) finding the source of the manganese of the Pierre Shale, conceivably buried under Pleistocene sedimentary rocks in central or western Minnesota or adjacent areas; (2) finding another Molango-type deposit by careful analysis of the distribution of manganese in certain miogeosynclinal carbonate rocks; or (3) finding the source of the high manganese concentrations in the Salton Sea brines. Much more promising modes of relieving dependence on foreign sources are by vigorously attempting to perfect techniques of effectively exploiting sea-floor nodules and by dissolving legal impediments to large-scale investment in subsea mining. Author

N74-15252 Geological Survey, Washington, D.C.
MERCURY c17
E. H. Bailey, A. L. Clark, and R. M. Smith *In its* US Mineral Resources 1973 p 401-414 refs (For availability see N74-15214 06-18)

The identified and speculative resources of mercury are discussed. The commercial applications of mercury are described. Methods for exploiting mercury production are reported. Data are presented to show the following: (1) mercury production and prices from 1850 to 1971, (2) the demand and domestic supply of mercury in the U.S. from 1850 to 1971, (3) uses and consumption of mercury in the U.S., and (4) mercury content of various natural substances. Author

N74-15253 Geological Survey, Washington, D.C.
MICA c17
Frank G. Lesure *In its* US Mineral Resources 1973 p 415-423 refs (For availability see N74-15214 06-18)

Sheet mica has been an important strategic mineral used in electrical appliances, vacuum tubes, capacitors, and various other electrical and nonelectrical products. The United States has not been self-sufficient in sheet-mica production since before the turn of the 20th century and has imported supplies to meet half to all of its needs, mostly from India, Brazil, and Malagasy Republic. Sheet mica uses are declining with advancing technology

and introduction of substitutes. Although the United States has undiscovered and paramarginal resources of sheet mica, the high cost of the necessary hand labor involved in mining and preparation of sheet mica deters exploration, development, or further mining. Average United States scrap-mica production is increasing, but reserves and resources are adequate for foreseeable demand. The United States is self sufficient in flake-mica production and is a net exporter of ground mica. Author

N74-15254 Geological Survey, Washington, D.C.
MOLYBDENUM c17
R. U. King, D. R. Shawe, and E. M. MacKevett, Jr. *In its* US Mineral Resources 1973 p 425-435 refs (For availability see N74-15214 06-18)

The geochemistry and mineralogy of molybdenum are discussed. The types of molybdenum deposits are described. Methods of prospecting for molybdenum are reported. Data are presented to show the location of molybdenum deposits in the U.S. and the estimated magnitude of world resources of molybdenum. The chemical and physical properties of molybdenum are analyzed. Author

N74-15255 Geological Survey, Washington, D.C.
NICKEL c17
Henry R. Cornwall *In its* US Mineral Resources 1973 p 437-442 refs (For availability see N74-15214 06-18)

At the present time the free world requirement of nearly 1 billion pounds of nickel per year is supplied from deposits of nickel sulfides, mostly in Canada, and of nickel laterites, mainly in New Caledonia. World resources from these types of deposits are estimated to total 70 million tons (140 billion pounds) of nickel in 7 billion tons of material averaging about 1 percent nickel. An additional 7 billion tons averaging 0.2 percent nickel, or 14 million tons of nickel, is estimated for sulfide deposits in the United States. The 0.2-0.4 percent of nickel universally disseminated in peridotites and serpentinites throughout the world amounts to a figure several orders of magnitude greater than 70 million tons, as does the quantity of nickel contained in deep-sea mangenese nodules; but new technological developments will be required to recover nickel successfully from these two types of occurrence. Author

N74-15256 Geological Survey, Washington, D.C.
NIOBIUM (COLUMBIUM) AND TANTALUM c17
Raymond L. Parker and John W. Adams *In its* US Mineral Resources 1973 p 443-454 refs (For availability see N74-15214 06-18)

Niobium (columbium) and tantalum have become important metals in modern technology because of their metallurgical, electronic, chemical, and nuclear uses. Both metals occur in nature almost entirely as single isotopes Nb93 and Ta181 and are present in the earth's crust in estimated abundance of 20 ppm (parts per million) and 2 ppm respectively. Niobium and tantalum have strong geochemical coherence and occur together in most rocks and minerals; however, some rock types such as nepheline syenite and carbonatites contain niobium in great preponderance over tantalum. These elements occur in minerals chiefly as oxides and multiple oxides, hydroxides, a few silicates, and one borate; more than 90 mineral species are known. Ore concentrations of niobium and tantalum occur in carbonatites and other rocks of alkalic complexes, certain types of granite, pegmatites, placers, and residual deposits. Author

N74-15257 Geological Survey, Washington, D.C.
NUCLEAR FUELS: URANIUM c17
Warren I. Finch, Arthur P. Butler, Jr., Frank C. Armstong, and Albert E. Weissenborn *In its* US Mineral Resources 1973 p 456-468 refs (For availability see N74-15214 06-18)

Uranium is an important energy resource, and even though the demand for its use in nuclear-powered electrical generators was only moderate in 1972, near-future needs are expected to be very great. In the United States, large exploitable deposits are found chiefly in sandstone and associated rocks. In other parts of the world, large deposits are mainly in quartz-pebble conglomerate of early Precambrian age and in veins. Domestic resources recoverable at present prices totaled about 273,000 tons of U3O8 at the end of 1971, and the total for all countries reporting resources is about 1.6 million tons of U3O8. These supplies are sufficient to last into the 1980's. Needs beyond 1980 are so great that tremendous efforts in exploration, and research in ore-finding techniques, will be required to discover new recoverable resources. Author

N74-15258 Geological Survey, Washington, D.C.
NUCLEAR FUELS: THORIUM c17
Mortimer H. Staatz and Jerry C. Olson *In its* US Mineral Resources 1973 p 468-476 refs (For availability see N74-15214 06-18)

Although the current demand for thorium is small, future needs may be large as a fuel for nuclear generators. The occurrence of thorium is widespread, and large deposits are found in beach and fluviatile placers, veins, sedimentary rocks, alkalic igneous rocks, and carbonatities. Thorium has been produced principally from monazite from beach and fluviatile placers, although in the 1950's and early 1960's monazite from a unique vein in South Africa was the chief source. In the early 1970's monazite was recovered principally as a byproduct of titanium or tin mining in India, Brazil, Australia, and Malaysia. A large thorium resource in the conglomerates at the Elliot Lake uranium mines, Canada, could become an important byproduct if demand increases. Thorium resources are not well known because of the small demand, but are sufficient for many years in the future. The development of a variable domestic thorium mining industry is dependent on a large enough increase in demand to exceed the amount obtainable as byproducts from other types of deposits. Author

N74-15259 Geological Survey, Washington, D.C.
OIL AND GAS
T. H. McCulloh *In its* US Mineral Resources 1973 p 477-496 refs (For availability see N74-15214 06-18)

The oil and gas resources of the United States are examined. Organic carbon, hydrocarbons, and producible hydrocarbon accumulations are discussed from the standpoint of distribution and accessibility. All estimates of petroleum and natural gas resources depend upon prior exploration results and are considered unreliable. Changing economic incentives, technologic advances, enlarged prospecting areas, and creative thinking all increase exploration effectiveness. Data are presented to show variations in produced and proven reserves of oil for the U.S. and the world. Author

N74-15260 Geological Survey, Washington, D.C.
OIL SHALE
William C. Culbertson and Janet K. Pitman *In its* US Mineral Resources 1973 p 497-503 refs (For availability see N74-15214 06-18)

Oil shale is a fine-grained sedimentary rock containing organic matter that has the property of yielding substantial amounts of oil when heated in a closed retort (destructive distillation) but that is mostly insoluble in ordinary petroleum solvents. The United States has tremendous quantities of oil shale, principally in the Green River Formation in Colorado, Utah, and Wyoming. These three States contain identified resources of about 1.8 trillion barrels of oil in oil shale that yields an average of 15 or more gallons per ton. However, no oil-shale venture has been a commercial success in the United States in the last 100 years, despite the fact that other countries of the world have for many years burned oil shale as a fuel, or have produced oil or combustible gas from the shale. Author

N74-15261 Geological Survey, Washington, D.C.
PEAT
Cornelia C. Cameron *In its* US Mineral Resources 1973 p 505-513 refs (For availability see N74-15214 06-18)

The physical characteristics of peat that are important to modern uses are related to the geologic and physiographic settings of the deposits. Research on methods of prospecting for peat focuses on establishing geologic controls for the types of peat defined in the classification adopted by the American Society for Testing and Materials in 1969. This new classification is designed principally to characterize different types of peat by means of such physical properties as amount, kind, and size of fibers and quantity of ash. One or more types of peat occur in all but about 8 of the 50 States in magnitudes ranging from hundreds of thousands to tens of billions of tons. The demand for specific physical qualities in peat related to modern uses

and to standards for sales is largely responsible for national consumption of more peat than is produced domestically.
Author

N74-15262 Geological Survey, Washington, D.C.
PHOSPHATE DEPOSITS
James B. Cathcart and R. A. Gulbrandsen *In its* US Mineral Resources 1973 p 515-525 refs (For availability see N74-15214 06-18)

Phosphorus, an element essential to plant growth, is found in igneous apatite, guano or related deposits, and marine phosphorite. Most of the United States' and the world's reserves and resources are in the marine phosphorite deposits which also account for about 75 percent of the total production. Marine phosphorite deposits, known throughout the world in rocks ranging in age from Precambrian to Holocene, form in basins away from sources of abundant clastic material in warm latitudes in areas of upwelling water. Because most of the sedimentary basins are known and phosphate occurs in many of them, resources are classed as identified or as hypothetical. Speculative resources form only a minor part of the total. However, identified resources of the world are measured in billions of tons of contained phosphorus and hypothetical resources are probably many times as great.
Author

N74-15263 Geological Survey, Washington, D.C.
PIGMENTS AND FILLERS
C. Ervin Brown *In its* US Mineral Resources 1973 p 527-536 refs (For availability see N74-15214 06-18)

Mineral fillers are finely ground, generally white, mineral or rock additives that impart necessary or desirable physical properties to a product. Mineral pigments are mineral-derived powders added for the sole purpose of giving color. The functions of fillers and pigments overlap inasmuch as one of the common purposes of a filler is coloring. The principal natural pigments are iron oxides, mainly hematite and limonite, that include various quantities of clay and some manganese dioxide. Mineral fillers are made from many rocks and minerals, but kaolin, limestone, and talc make up about 84 percent of the total consumption. Fillers are essential components in paint, paper, plastics, pesticides, rubber, roofing, and fertilizer. Many fillers can be substituted for each other, but some have unique properties needed by certain products.
Author

N74-15264 Geological Survey, Washington, D.C.
PLATINUM-GROUP METALS **c17**
Norman J. Page, Allen L. Clark, George A. Desborough, and Raymond L. Parker *In its* US Mineral Resources 1973 p 537-545 refs (For availability see N74-15214 06-18)

Platinum, palladium, iridium, osmium, rhodium, and ruthenium are the platinum-group metals. Platinum and palladium are the most abundant of this group, but all these metals are essential to modern industry where their applications are based on their catalytic properties, electrical conductivity, and resistance to chemical corrosion, heat, and oxidation. About 1.3 million ounces per year of platinum-group metals are consumed in the United States (1) by electrical manufacturers as electrical contacts in high-precision instruments and insoluble anodes for metallurgical processing; (2) by the chemical industry as catalytic gauze for oxidation of ammonia and the manufacture of nitric acid; (3) in petroleum refining as a catalyst to produce high-octane gasoline; (4) in dental and medical devices; (5) in decorative arts and jewelry; and (6) as spinnerettes used in manufacturing glass and synthetic fibers.
Author

N74-15265 Geological Survey, Washington, D.C.
RARE-EARTH ELEMENTS
John W. Adams and Mortimer H. Staatz *In its* US Mineral Resources 1973 p 547-556 refs (For availability see N74-15214 06-18)

The rare-earth metals, which include yttrium and the lanthanides, consist of a group of geochemically related elements that have become of increasing economic interest, largely on the basis of their physical rather than their chemical properties. Their greatest present use is in petroleum-cracking catalysts, but they are also extensively used in the glass and ceramics industries, in iron and steel production, and in the manufacture of electronic devices. Some members of the group are relatively abundant in the earth's crust, but minable concentrations are uncommon. Bastnaesite, a rare-earth fluocarbonate, and monazite, a rare-earth phosphate, are the two important ore minerals. Bastnaesite is mined extensively from carbonatite in California, and monazite is recovered largely from placer deposits in various parts of the world. The rare earths are present in many other minerals, either as essential constituents or as substituted constituents.
Author

N74-15266 Geological Survey, Washington, D.C.
RHENIUM **c17**
R. U. King *In its* US Mineral Resources 1973 p 557-559 refs (For availability see N74-15214 06-18)

Rhenium, a rare element that has only recently come into significant industrial use, has properties excellently suited for application as a refractory metal, as an alloying element, in high-temperature thermocouples, in electronic components, and as a catalyst in petroleum refining. Rhenium is obtained from molybdenite that is recovered as a byproduct of copper production, and the supply of rhenium, as well as the world resources of rhenium is therefore closely tied in with the world's resources of molybdenum in porphyry copper deposits. Identified U.S. resources of rhenium are estimated to be about 10,000 short tons, and world resources on the order of 30,000 short tons. Although other sources may exist, they are not known to be significant.
Author

N74-15267 Geological Survey, Washington, D.C.
SAND AND GRAVEL
Warren Yeend *In its* US Mineral Resources 1973 p 561-565 refs (For availability see N74-15214 06-18)

The extent of the sand and gravel industry in the United States is discussed. Although the U.S. currently produces enough sand and gravel to supply its requirements, it is predicted that by A.D. 2000 the domestic resources accessible at 1968 prices will barely meet the demand. The most important commercial sources of sand and gravel are river channels and glaciated terrain. Marine and lake environments provide a secondary source. Deposits are located by conventional field mapping with the aid of geophysical techniques, such as seismic refraction and reflection and resistivity surveys.
Author

N74-15268 Geological Survey, Washington, D.C.
SCANDIUM **c17**
John W. Adams *In its* US Mineral Resources 1973 p 567-571 refs (For availability see N74-15214 06-18)

Scandium is a rare metal that at present has only minor industrial applications. Geochemically, it is a highly dispersed element that occurs chiefly in trace amounts in the ferromagnesian minerals of igneous rocks. Scandium may be concentrated in pegmatites, some of which have been mined for thortveitite, one of the few independent scandium minerals. It may also be present in anomalously high amounts in some phosphate deposits and tungsten ores. Some scandium has been produced from domestic and foreign uranium ores in mills where it accumulated in residues that developed during the extraction of uranium. Scandium apparently is not being recovered from any source at the present time, but if demand were to increase, the element could be obtained again as a byproduct of uranium-ore processing as well as from certain tungsten ores and phosphatic rocks.
Author

N74-15269 Geological Survey, Washington, D.C.
SELENIUM
H. W. Lakin and D. F. Davidson *In its* US Mineral Resources 1973 p 573-576 refs (For availability see N74-15214 06-18)

The present demand for selenium is shown to be less than the amount available as a byproduct from the copper industry. Two factors are identified which may result in a severe shortage of selenium in the U.S. in the future. These include: (1) in situ leaching of copper from its ores which leaves the associated selenium undissolved in the waste rock resulting from the process, and (2) the increasing use of selenium as a soil additive. The latter factor is anticipated to require a minimum of 10 times the present annual production of selenium. Statistics relating to U.S. and world production and consumption of selenium are presented. Resources are identified and estimates of their present yield and future potential are given.
Author

N74-15270 Geological Survey, Washington, D.C.
SILICA SAND
Keith B. Ketner *In its* US Mineral Resources 1973 p 577-580 refs (For availability see N74-15214 06-18)

The production and consumption of silica sand in the U.S. and the world are analyzed. It is shown that silica sand formations and the quartz sandstones from which silica sand and silicon are mainly derived are abundantly distributed throughout the United States and the world. Although the use of silica-sand, principally in the glass and metallurgical industries, is rapidly increasing, shortages that might cause heavy reliance on imports are not likely. Problems are caused if urban development preempts the surface over valuable silica sand deposits and if abandoned sandpits are left in a useless condition. Urban planners can solve the first problem by restricting important sand deposits from other long-term uses, and industry can solve the second by contouring the disturbed surface for productive or recreational use. More detailed geologic investigations in urban areas are needed to precisely delineate silica-sand deposits in advance of urban development. Author

N74-15271 Geological Survey, Washington, D.C.
SILVER **c17**
Allen V. Heyl, W. E. Hall, Albert E. Weissenborn, H. K. Stager, W. P. Puffett, and Bruce L. Reed *In its* US Mineral Resources 1973 p 581-603 refs (For availability see N74-15214 06-18)

A study of silver resources indicates that a major worldwide imbalance of more than 100 million ounces per year exists between production and consumption. The silver used in photography alone in the United States is greater than our annual production, and most of this silver is not recovered for reuse. The deficit between domestic production and consumption formerly was partly filled by withdrawal from the U.S. Treasury silver reserves, but these reserves are now depleted. Identified resources of silver in the United States comprise an estimated 1,440 million troy ounces economically recoverable at present prices (reserves) and an estimated 750 million ounces in material nearly commercial in grade (conditional resources). Other conditional resources that might become recoverable at significantly higher prices are roughly estimated to be of about the same magnitude as the present reserves. Only about 35 percent of the identified resources is in deposits that would yield silver as the main product; the remaining 65 percent would be recovered as a byproduct. Author

N74-15272 Geological Survey, Washington, D.C.
SULFUR
Alfred J. Bodenlos *In its* US Mineral Resources 1973 p 605-618 refs (For availability see N74-15214 06-18)

A survey on sulfur indicates that reserves are appreciable and resources are vast, not only in the U.S. but in many other parts of the world. Research shows that elemental sulfur is formed as a product of anaerobic bacterial activity wherever both sulfate ions and organic material are abundant; therefore, areas of potential sulfur discovery include anhydrite units in any petroliferous evaporite basins. Most accumulations of petroleum and natural gas high in sulfur content also are found in evaporite basins. Sulfide ores, in contrast, occur in a wide variety of rocks in all parts of the world. Volcanic sulfur occurs mostly in the circum-Pacific belt, but it also has been found in volcanoes extending from the Mediterranean to the Himalaya Mountains. Most countries contain sulfur-bearing accumulations in one form or another, but few contain large deposits of elemental sulfur. The extraction of sulfur from such accumulations in any given country depends largely upon recovery costs. Author

N74-15273 Geological Survey, Washington, D.C.
TALC
C. Ervin Brown *In its* US Mineral Resources 1973 p 619-626 refs (For availability see N74-15214 06-18)

Data pertaining to the production and consumption of talc are presented. It is shown that in 1969 and 1970, total consumption was over a million tons -- double that of 20 years ago. The projected demand for the year 2,000 ranges from 2.28 to 3.36 million tons. Resources of talc are large and should be adequate to meet this demand, although deposits meeting the rigid chemical and physical specifications of some consumer industries are relatively scarce. Although all talc mining districts contain known reserves and have a good to excellent potential for the discovery of additional reserves, the great bulk of reserves are in New York and Vermont. Most industrial areas of the United States are fairly close to a source of industrial talc, except for the industries of the midcontinent. Areas of metamorphic rocks in Wisconsin and Michigan could contain talc deposits more favorably located for the midcontinent market. Author

N74-15274 Geological Survey, Washington, D.C.
TELLURIUM **c17**
D. F. Davidson and H. W. Lakin *In its* US Mineral Resources 1973 p 627-630 refs (For availability see N74-15214 06-18)

Supply and demand studies of tellurium indicate that the present demand for tellurium is less than the amount available as a byproduct from the copper and lead industries. A shortage of tellurium could develop as a result of a change in the processes of recovery of copper from its ores. In-place leaching of copper from its ores leaves the associated tellurium undissolved in the waste rock resulting from the process. Thus, as the use of the leaching process increases at the expense of smelting, the supply of tellurium will decrease. Identified resources of copper in the United States are estimated to contain about 13.5 million pounds of recoverable tellurium. Tellurium may be recovered as a byproduct in burning of coal in huge powerplants, paying in part for environmental improvement. The major resource of tellurium is found in manganese oxide nodules on the ocean floors. Author

N74-15275 Geological Survey, Washington, D.C.
THALLIUM **c17**
Keith Robinson *In its* US Mineral Resources 1973 p 631-636 refs (For availability see N74-15214 06-18)

Statistics and related information concerning the production and consumption of thallium are presented. The current uses for thallium are limited, being primarily confined to electronics and metallurgical processing; lesser applications are in glass, explosives, agriculture, and medicine. U.S. and total world identified resources of thallium from zinc, lead, and iron sulfides are estimated at 266 and 1,390 tons respectively. Additional U.S. and total world resources contained in coal ash are 119,000 and 715,000 tons. Identified manganese nodules occurring on the sea floors are estimated to contain 9.9 million tons of thallium. Assuming no unforeseen demand, the world supply of thallium from identified zinc sulfide sources will be exhausted in 43 years at the present rate of consumption, and from all identified sulfide sources in 70 years. Author

N74-15276 Geological Survey, Washington, D.C.
TIN **c17**
C. L. Sainsbury and Bruce L. Reed *In its* US Mineral Resources 1973 p 637 refs (For availability see N74-15214 06-18)

Data relating to the production and consumption as well as the uses of tin are reported. The United States consumes almost 30 percent of the free world's annual production of primary tin. Nearly half this amount is used in the manufacture of tinplate, principally for tin cans; the other main uses are in solders, bearing alloys, bronze, chemicals, and coatings other than tinplate. Current U.S. tin production, as a byproduct of molybdenum mining in Colorado, is negligible. The strategic stockpile is sufficient to guarantee against a sudden shortage of primary tin for essential uses, but as the current rate of consumption even this supply would be depleted in a little more than 4 years. Domestic reserves of tin, mainly in Alaska, would provide only about three-fourths of a year's supply, conditional resources about the same, and hypothetical and speculative resources about 2 years' supply; thus, it seems clear that the United States must continue to depend on tin imports for most of its needs. Author

N74-15277 Geological Survey, Washington, D.C.
TITANIUM **c17**
Harry Klemic, Sherman P. Marsh, and Margaret Cooper *In its* US Mineral Resources 1973 p 653-665 refs (For availability see N74-15214 06-18)

A survey of titanium production and consumption is presented. Rutile, ilmenite, and titanium slag made from ilmenite are the principal raw materials from which purified titanium products are extracted. The Kroll method, involving reduction of titanium tetrachloride in an inert atmosphere, is used to obtain

metallic titanium. The United States is dependent almost entirely upon foreign sources, mostly Australia, for rutile, but has substantial reserves and production of ilmenite. In 1970, U.S. demand for titanium was 490,000 short tons, and annual demand is expected to exceed 1 million short tons by the year 2000. U.S. and world identified resources are estimated to be about 298 million and 2,000 million short tons of TiO2, respectively. Reserves of titanium in the United States in 1970 were estimated to be about 25 million short tons of TiO2, mostly in ilmenite.
Author

N74-15278 Geological Survey, Washington, D.C.
TUNGSTEN c17
S. Warren Hobbs and James E. Elliott *In its* US Mineral Resources 1973 p 667-678 refs (For availability see N74-15214 06-18)

Data are presented pertaining to the production and consumption of tungsten. U.S. tungsten reserves in known deposits or their geologically reasonable extensions are estimated at 15 million short ton units (1 short ton unit = 20 pounds WO3). This is about 6.8 percent of known world reserves, of which approximately 60 percent are in China. Subeconomic resources in identified or geologically plausible deposits in the United States are conservatively estimated to contain two to three times the reserves. Covered areas in the United States probably contain concealed deposits that are comparable in grade and total tonnage to those now known. The United States has the potential for adequate tungsten production into the foreseeable future, provided it is willing to pay the price of essential research, extensive exploration, and the processing of high-cost low-grade ores.
Author

N74-15279 Geological Survey, Washington, D.C.
VANADIUM c17
R. P. Fischer *In its* US Mineral Resources 1973 p 679-688 refs (For availability see N74-15214 06-18)

A survey on the uses, production, and consumption of vanadium is reported. Vanadium is used mainly as an alloy agent in steel. Its domestic consumption increased rapidly during the 1960's, and a growth rate of demand higher than that of any other ferrous mineral has been predicted to the year 2000. Foreign uses, consumption, and predicted requirements have a similar pattern. Predicted domestic requirements to the year 2000 exceed the estimated amount of vanadium available from productive domestic sources by about 300,000 to 400,000 short tons. Domestic resources in magnetic deposits and in carbonaceous shales are adequate to furnish this deficient vanadium, but they can do so only if domestic metallurgical practices are modified or new ones are developed. Foreign reserves in productive titaniferous magnetite deposits and resources in known but unproductive deposits of this type are adequate to satisfy world requirements for vanadium in the foreseeable future. Author

N74-15280 Geological Survey, Washington, D.C.
ZEOLITES IN SEDIMENTARY ROCKS c18
Richard A. Sheppard *In its* US Mineral Resources 1973 p 689-695 refs (For availability see N74-15214 06-17)

Research indicates that the production of natural zeolites in the United States is currently only several hundred tons per year. The abundance and variety of zeolite deposits in the United States, the unique properties of the zeolites, and the seemingly low cost of mining suggest potential uses in many industrial and agriculture processes. Chemical and structural modifications of the natural materials could further increase their potential. When new markets for zeolites are developed, the United States will not only be self-sufficient but will probably become a major exporter. The total of identified, hypothetical, and speculative resources of zeolites in the United States is conservatively estimated at more than 10 trillion tons. Total resources of zeolites in the rest of the world have not yet really begun to be cataloged.
Author

N74-15281 Geological Survey, Washington, D.C.
ZINC c17
Helmuth Wedow, Jr., Thor H. Kiilsgaard, Allen V. Heyl, and Robert B. Hall *In its* US Mineral Resources 1973 p 697-711 refs (For availability see N74-15214 06-18)

A survey on the production and consumption of zinc is reported. Today it stands, in tonnage produced, as the fourth most important metal in world trade. About 150 million metric tons has been used since the beginning of the 19th century, and projected growth rates suggest that this amount will more than double by the end of the 20th century. Current annual world production exceeds 5 million metric tons. Of this tonnage the United States produces about 9 percent, but it consumes more than three times the amount it produces. World resource estimates indicate that recoverable identified resources (that is, reserves) are about 235 million metric tons, of which 45 million is in the United States. Total world identified and undiscovered zinc resources are estimated at over 5 billion metric tons, about one-tenth of which is in ores of grade sufficient to be exploitable under existing economic conditions.
Author

N74-15282 Geological Survey, Washington, D.C.
ZIRCONIUM AND HAFNIUM c17
Harry Klemic, David Gottfried, Margaret Cooper, and Sherman P. Marsh *In its* US Mineral Resources 1973 p 713-722 refs (For availability see N74-15214 06-18)

Statistical data and related information on the production and consumption of zirconium and hafnium are presented. Zircon and baddeleyite are the principal sources of zirconium, and hafnium is recovered in extracting reactor-grade zirconium. Zircon and baddeleyite occur as primary minerals in alkaline-rich igneous rocks, but zircon is recovered mainly from titanium-bearing placer sands. The United States is a major producer and consumer of zircon and imports large quantities from Australia, which is the world's largest producer of zircon. Identified resources of zircon in the United States are about 10,800,000 short tons, of which nearly 80 percent is in the Atlantic Coastal States. U.S. production is solely from Florida and Georgia. World identified resources exceed 36 million short tons of zircon equivalent. World production of zirconium concentrates in 1970 was more than 450,000 tons. Of this, the United States used about 30 percent. Current supplies of zircon exceed demand for a few decades.
Author

N74-15283*# Scientific Translation Service, Santa Barbara, Calif.
ELECTRODE POLARIZATION IN FUSED SILICATES AND THE FORMATION OF BIVALENT SILICON
O. A. Yesin and L. K. Gavrilov Washington NASA Jan. 1974 10 p refs Transl. into ENGLISH from Zh. Fiz. Khim. (Moscow), v. 30, no. 2, 1956 p 374-378
(Contract NASw-2483)
(NASA-TT-F-15264) Avail: NTIS HC $3.00 CSCL 11D

Experiments were conducted with fused silicates with ferrophosphorous electrodes and ferrosilicon electrodes to investigate electrode polarization. Several models of this effect are evaluated, and further research is required to establish the correct one.
Author

N74-15284# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.
PREPARATION OF GRAPHITE IMPREGNATED WITH GLASSES OR MOLTEN CERAMICS AT HIGH TEMPERATURE
H. Burg, E. Parnisari, and F. VanRutten Jun. 1973 29 p refs In FRENCH
(EUR-5018) Avail: AEC Depository Libraries HC $3.50; EUR FB 40.

A study was made to find a method of impregnating graphite using molten ceramics or glasses. The different ceramics and glasses selected should give an impregnated impervious graphite, having acceptable nuclear properties. Experimental tests were done on the behavior of these materials during annealings and thermal cycling up to 1000 C.
Author (NSA)

N74-15285# Interuniversitair Reactor Instituut, Delft (Netherlands).
THE FLATTENING OF OIL DROPLETS ON A GLASS PLATE [DE AFPLATTING VAN OLIEDRUPPELTJES OP EEN GLASPLAAT]
F. C. VanBeukering, A. VantRiet, and G. A. Ferron Sep. 1973 9 p refs In DUTCH
(IRI-190-73-01) Avail: NTIS HC $3.00

The flattening of oil drops on a glass plate was measured, and the influence of evaporation on the measured particle size

distribution of Shell Turbo 33 occurring as aerosol in a factory atmosphere was established. A thermal precipitator was used to obtain a representative sample of the aerosol. The aerodynamic diameter of the oil drops, being equal to a constant times the real diameter, was measured with a special centrifuge according to Stobe. A flattened oil drop with an original diameter of one micrometer evaporates in 30 mins if the air is not saturated with oil vapor. The evaporation rate was found to be proportional to the square of the diameter so that evaporation is important for small drops only. ESRO

N74-15286# Defence Research Information Centre, Orpington (England).
THE INTERFERENCE-FREE MEASUREMENT OF THE WEIGHT PER UNIT AREA OF MESHED MATERIAL
G. Buehler Jul. 1973 33 p refs Transl. into ENGLISH from Melliand Textilber. Intern. (Heidelberg), v. 53, no. 11, 1972 p 1236-1244
(DRIC-Trans-3197; BR30541) Avail: NTIS HC $3.75

The use of nondestructive radiometric techniques for the determination of weight unit area of woven textiles is discussed. The advantages of these techniques as opposed to conventional destructive gravimetric ones are discussed. Applications with transmitted radiation and with backscattering measuring equipment using krypton 85 as a radio source are described, both for a central measurement location and for a circular knitting machine. Factors influencing evaluation and application of the recorded data are considered. ESRO

N74-15287# Explosives Research and Development Establishment, Waltham Abbey (England).
AN ASSESSMENT OF RECENTLY DEVELOPED THERMOPLASTIC POLYURETHANE AND POLYESTER ELASTOMERS
J. Wright Apr. 1973 26 p refs
(ERDE-TR-138; BR36668) Avail: NTIS HC $3.50

The processing characteristics and aging properties of thermoplastic, injection molded polyurethane and polyester copolymer elastomers were assessed. The aging properties of the polyurethanes showed little improvement compared with cast and millable polyurethane elastomers, although their processibility was easier and they could be more economical for large number production of small components. The polyester copolymers have very good mechanical and aging properties and should be considered as serious candidates for replacing conventional elastomers in many high performance applications.
Author (ESRO)

N74-15288# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France). Dept. d'Etudes de Recherches en Technologie Spatiale.
IMPACT CRATERS INDUCED IN BRITTLE MATERIALS [CRATERES D'IMPACT PRODUITS SUR DES MATERIAUX FRAGILES]
J. C. Mandeville 1973 16 p refs In FRENCH
(ONERA-DERTS-NT-01-16) Avail: NTIS HC $3.00

Some experimental results from studies of craters occurring in granite, basalt and pyrex targets and caused by the impact of small metallic spheres propagating at velocities between 1.5 and 3 km/sec are reported. The effects of variations of the mass, propagation velocity, and kinetic energy of projectiles on the depth, diameter, and mass transfer of craters was investigated. ESRO

N74-15289# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France). Dept. d'Etudes et de Recherches en Technologie Spatiale.
RADIATION INDUCED DEGRADATION MECHANISMS IN POLYMERS [LES MECANISMES DE DEGRADATION SOUS RAYONNEMENTS DANS LES POLYMERES]
A. Paillous Oct. 1973 31 p refs In FRENCH
(ONERA-DERTS-NT-03-9) Avail: NTIS HC $3.75

In order to optimize space environment simulation conditions, radiochemical and photochemical reactions occurring in polymers exposed to ultraviolet, proton, and electron radiation were investigated. Irradiation equivalence effects, synergy, intensity, and temperature effects were included. ESRO

N74-15290# National Commission on Materials Policy, Washington, D.C.
COMPENDIUM OF UNIVERSITY FORUMS OF THE NATIONAL COMMISSION ON MATERIALS POLICY, MAY - JUNE 1972. A BACKGROUND DOCUMENT: UNIVERSITY FORUM ON NATIONAL MATERIALS POLICY, MASSACHUSETTS INSTITUTE OF TECHNOLOGY ON 30 MAY - 2 JUNE 1972
Allen F. Agnew Aug. 1973 733 p refs
(PB-223678/4GA; NCMP-UF-3) Avail: NTIS HC $38.75 CSCL 05C

The Massachusetts Institute of Technology Forum covered six subjects: materials problems in energy conversion, research in advanced materials; national policy on resources, waste recycling, and education and a national materials policy. Specialty metals, coal conversion, electronic materials, aerospace structural materials, biomaterials, and polymeric materials were all considered in depth as were recycling of solid refuse and the effect of recycling on materials supply. Relationships to man were examined via the topic human ecology and compatible technology. GRA

N74-15291# National Bureau of Standards, Washington, D.C. Inorganic Materials Div.
INVESTIGATION OF VISCOUS FLOW IN GLASS DURING PHASE SEPARATION Annual Report, Nov. 1972 - Jun. 1973
J. H. Simmons, S. A. Mills, A. Napolitano, D. H. Blackburn, and W. K. Haller Sep. 1973 44 p refs
(Contract NAonr-12-73; NR Proj. 032-536; NBS Proj. 31304) (AD-767920; NBS-TN-792; AR-1) Avail: NTIS MF $1.45; SOD HC $0.65 as C13.46:792 CSCL 11/2

The isothermal viscosity of two borosilicate glasses, of which one is a commercial glass widely used for chemical glassware, shows a large increase (4 to 5 orders of magnitude) with heat-treatment time (ranging up to 100,000 min) near the annealing point. The two glasses have similar compositions, but differ greatly in their phase separation characteristics. Electron micrographs are used to analyze the development of microstructure during the suspected phase separation. In both glasses, it is found that the structure development is primarily responsible for the viscosity increase. An analysis of the data, and a theoretical interpretation of the effect are presented.
Author (GRA)

N74-15292# Massachusetts Univ., Amherst. School of Engineering.
EFFECT OF POLYMERIC COATINGS ON STRENGTH OF SODA-LIME GLASS
John E. Ritter, Jr. Jul. 1973 28 p refs
(Contract N00014-68-A-0146; NR Proj. 200-016) (AD-767065; UM-73-6) Avail: NTIS CSCL 11/2

The effectiveness of polymeric coatings (acrylic, epoxy, and silicone) in preventing stress corrosion was determined by measuring the loading rate sensitivity of bend strength for coated, abraded and acid-polished soda-lime glass. The coatings were found to limit the availability of water to the glass surface and, thereby, cause an increase in the strength of abraded glass. The coatings also significantly improved the mechanical abrasion resistance of the acid-polished glass. However, the coatings did not eliminate the stress corrosion reaction between water and the glass surface and, hence, did not affect the sensitivity of glass strength to loading rate. During the testing program, it became evident that significant friction can arise during the bending test due to the supports digging into the coatings. Therefore, the differential equations governing beam deflection in four-point bending were solved to include frictional forces between the test samples and the supports. The results of the bending analysis showed that frictional forces become significant at large deflections and can cause an increase in the observed strength. Author (GRA)

N74-15293# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.
THE STRESS INTENSITY OF A CRACK AT AN INTERFACE BETWEEN TWO MATERIALS Interim Report
Kuen-Yuan Lin Jun. 1973 55 p refs
(Contract F44620-70-C-0020; AF Proj. 9782)

(AD-768636; ASRL-TR-162-5; AFOSR-73-1917TR) Avail: NTIS CSCL 11/4

An understanding of the stress distributions in the inhomogeneous fiber/matrix interface regions is required to predict crack extension behavior in composite structures. The stress singularity at the tip of a crack, either lying along or perpendicular to the interface of the two materials, is first investigated by the complex variable method. The order of the singularity is shown to be dependent on both the crack geometry and two parameters alpha, beta which are related to the four elastic constants of the two materials. A hybrid crack element is constructed to properly account for the cracks tip singularity. The stress intensity factor for cracks in different bimarterial continua are then calculated using the finite element method. (Modified author abstract) GRA

N74-15294# Dow Chemical Co., Midland, Mich.
EXPEDIENT SURFACING MATERIALS
H. E. Filter and S. S. Drake Oct. 1973 159 p refs
(Contract F29601-71-C-0092; AF Proj. 683M; AF Proj. 437A)
(AD-768450; AFWL-TR-73-70) Avail: NTIS CSCL 13/3

A study of resin viscosity versus temperature over the range of 0 to 125F. showed the need for two resin systems to meet the requirement of 1600 cps maximum viscosity. A primary (high temperature, 32 to 125F.) resin and a secondary (low temperature, minus 15 to plus 65F.) resin were specified for development. The study of catalysis was a major effort with both the primary and secondary resin systems. One of the major discoveries of the program was the gel retardant effect of certain ketone peroxides. The primary resin system is composed of ALTEK and DERKANE. The secondary resin system consists of COREZYN with added styrene and monochlorostyrene, and DERKANE 470. Both resin systems meet requirements for strength, cure, gel time, viscosity, combustibility, shelf life, and chemical and weather resistance for temporary roads, runways and other load bearing materials. GRA

N74-15295# Midwest Research Inst., Kansas City, Mo.
GRAPHITE FLUORIDE: A PROPOSED SOLID LUBRICANT Technical Report, 3 Jan. - 1 Dec. 1972
Karl R. Mecklenburg and B. D. McConnell Apr. 1973 49 p refs
(Contract F33615-72-C-1374; AF Proj. 7340; AF Proj. 7343)
(AD-768924; AFML-TR-73-121) Avail: NTIS CSCL 11/8

Graphite fluoride, a proposed solid lubricant material, was evaluated with a sphere-on-plane tester to determine if previously generated data could be reproduced. Preliminary experiments with (CFx)n (graphite fluoride), substituted in existing film formulations in place of MoS2, revealed extremely short wear-lives when other test geometries were used. However, with the sphere-on-plane configuration, the data previously reported were reproduced. Wear-lives and friction coefficients for burnished MoS2 and (CFx)n are presented, along with friction coefficients for the bare metal combinations used. Also included are compressive stress values in the test zone based upon the starting and finishing contact areas. Author (GRA)

N74-15296# Pittsburgh Univ., Pa. Dept. of Metallurgical and Materials Engineering.
STRUCTURE AND PROPERTIES OF MELT GROWN NB-NB2C COMPOSITES
Stan A. David and Harold D. Brody 1 Sep. 1973 42 p refs
(Contract N00014-67-A-0402-0003)
(AD-768395; MME-HDB-73-R1) Avail: NTIS CSCL 11/4

The report consists of two preprints. One preprint describes a process for growing eutectic and hypereutectic Nb-Nb2C composites by an electron beam floating zone freezing technique. The structure is characterized as a function of carbon content and growth rate. The conditions for interface stability in the Nb-Nb2C system are compared to present theoretical models. The second preprint discusses sources of banding in composite growth and pays particular attention to banding that results from nonuniformity in the feed rod. This mechanism is important in composite growth techniques employing zone melting and may be avoided by zone levelling prior to composite growth.
Author (GRA)

N74-15297# Battelle Columbus Labs., Ohio.
ANALYTICAL INVESTIGATION OF STRESS CONCENTRATIONS DUE TO HOLES IN FIBER REINFORCED PLASTIC LAMINATED PLATES, THREE-DIMENSIONAL MODELS Technical Report, 15 Jan. 1972 - 15 Jan. 1973
Edmund F. Rybicki and Allen T. Hopper Mar. 1973 54 p refs
(Contract F33615-72-C-1239; AF Proj. 7342)
(AD-768453; AFML-TR-73-100) Avail: NTIS CSCL 11/4

A three-dimensional analysis for the stress distributions around a hole in a laminated plate is presented. The method of stress analysis is based on a complementary energy formulation with three-dimensional equilibrium finite elements. Three Maxwell stress functions are associated with each element. Finite element representations for the stress functions include positive and negative powers of the radial coordinate, r. This representation was found to give better stress solutions than the conventional representations with only positive powers of r. Numerical verification checks of the analysis for two-dimensional problems are presented. Three-dimensional finite element solutions are presented for four- and six-layered plates with symmetric lay-up angles. Material properties representing boron/epoxy laminas are used. Problems are selected to show the influence of laminate stacking sequence on the transverse normal and shear stresses around the hole. Stresses obtained from two-dimensional effective modulus representations are compared with three-dimensional results. Author (GRA)

N74-15298# Virginia Polytechnic Inst. and State Univ., Blacksburg. Coll. of Engineering.
EFFECTS OF CYCLIC FREQUENCY ON THE MECHANICAL PROPERTIES OF COMPOSITE MATERIALS Interim Technical Report
Wayne W. Stinchcomb, Kenneth L. Reifsnider, Larry A. Marcus, and Richard S. Williams Jun. 1973 39 p refs
(Grant AF-AFOSR-2358-72; AF Proj. 9781)
(AD-768614; VPI-E-73-25; AFOSR-73-1907TR) Avail: NTIS CSCL 11/4

Strain controlled cyclic stress-strain and fatigue tests were conducted on specimens of boron-epoxy and boron-aluminum at cyclic frequencies between 0.5 Hz and 45 Hz. The specimens were cross-ply laminates with a (0 degree, plus or minus 45 degree, 0 degree)s fiber orientation and had a 0.25 in. hole in the center. The results of data obtained from both types of tests showed the response of the material to be frequency and cycle dependent. The marked difference in behavior of the material at 15 Hz and 30 Hz suggests the presence of a transition frequency (or frequency range) at which the properties of the material are greatly influenced by frequency controlled mechanisms. At a given frequency, changes in properties occur with increasing cycles and correlate with acoustic emissions monitored during the test. Author (GRA)

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

N74-15299 Illinois Inst. of Tech., Chicago.
ESTIMATION OF THE AVERAGE FREQUENCY OF A RANDOM PROCESS Ph.D. Thesis
John Joseph Herro 1973 116 p
Avail: Univ. Microfilms Order No. 73-27053

This work is to develop, a means of estimating, in real time, the average frequency of a random process, given by a time-limited sample of that process. Motivation for this study is found in the field of radar meteorology. In a rainstorm, the velocity of each falling raindrop is a direct function of its size. If the rainstorm is observed with a doppler radar the average frequency of the return signal gives the meteorologist useful information about the sizes of the raindrops present. The average frequency of a random process is defined in terms of the power spectral density. Previous estimators of average frequency were mathematically based on estimating the power spectral density. In this work the average frequency is expressed in terms of the

autocorrelation and cross-correlation functions, and a new estimator is obtained which is based on estimates of these correlation functions. Dissert. Abstr.

N74-15300# Research Inst. of National Defence, Stockholm (Sweden).
ON THE EXISTENCE OF EQUILIBRIUM POINTS FOR CERTAIN n-PERSON GAMES
Tomas Bjoerk Oct. 1973 4 p refs
(FOA-P-B-8025-M3; ISBN-91-7056-024-2) Avail: NTIS HC $3.00

N-person games played on compact, metric spaces and having continuous payoff functions are treated. Using an approximation technique, a proof of existence of equilibrium points in mixed strategies is given for such games. Author

N74-15301# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
ON THE TERMINAL CONTROL PROBLEM
Avraham M. Steinberg and Kalmi Shmueli, (Min. of Def., Tel-Aviv, Israel) Jun. 1972 22 p refs
(TAE-156) Avail: NTIS HC $3.25

A minimum time problem is considered, where the final point is locally controllable. It is shown, that it is possible to construct a suboptimal control with a transfer time close to the optimal transfer time of the relaxed system. The resulting trajectory will satisfy initial and final conditions. Furthermore it is shown that if an optimal solution exists for the problem, then this solution is also an optimal solution of the relaxed problem. In this case, the relaxed problem need not be solved. Author

N74-15302# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
ON EXISTENCE OF OPTIMAL CONTROLS
Avraham M. Steinberg and Harold L. Stalford (NRL, Washington, D. C.) Jul. 1972 21 p refs
(TAE-158) Avail: NTIS HC $3.00

An optimal control is shown to exist for a system x sup dot = f(x,t,u) when the Hamiltonian is a strictly convex function of the control. It is proven that a system satisfying this condition must have state equations that are linear in the control and a cost functional whose integrand is strictly convex in the control. Author

N74-15303# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
CONVERGENCE PROPERTIES OF THE PARAMETER VECTOR IN REAL TIME IDENTIFICATION OF LINEAR SYSTEMS
S. J. Merhav and E. Gabay Oct. 1972 57 p refs Sponsored by Min. of Def.
(TAE-166) Avail: NTIS HC $5.00

The convergence properties of the parameter vector in a real time identification process of linear systems are investigated. The system is identified in terms of the coefficients of its differential equation, and globally asymptotically stable solutions can be obtained. If all the components of the parameter vector converge uniquely from some initial set of values to their steady-state in a finite interval of time, the system is completely identifiable. Employing a statistical approach the ensemble averaged convergence contains all the data regarding input, order and structure of the system, type of criterion function and descent law. The principal factors which determine the parameter noise vector are analyzed. The concept of criterion surface elongation which is introduced, serves as an effective figure of merit from which the convergence process can be predicted. Author

N74-15304*# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Mathematics and Statistics.
KULLBACK-LEIBLER INFORMATION FUNCTION AND THE SEQUENTIAL SELECTION OF EXPERIMENTS TO DISCRIMINATE AMONG SEVERAL LINEAR MODELS Ph.D. Thesis
Steven Michael Sidik 7 Jun. 1972 135 p refs Sponsored by NASA
(NASA-CR-136615) Avail: NTIS HC $8.75 CSCL 12A

A sequential adaptive experimental design procedure for a related problem is studied. It is assumed that a finite set of potential linear models relating certain controlled variables to an observed variable is postulated, and that exactly one of these models is correct. The problem is to sequentially design most informative experiments so that the correct model equation can be determined with as little experimentation as possible. Discussion includes: structure of the linear models; prerequisite distribution theory; entropy functions and the Kullback-Leibler information function; the sequential decision procedure; and computer simulation results. An example of application is given. K.M.M.

N74-15305# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computing.
CUBIC-SPLINE FITTING WITH CONVEXITY AND CONCAVITY CONSTRAINTS
M. G. Cox Jun. 1973 30 p refs
(NPL-NAC-23) Avail: NTIS HC $3.50

A straight forward extension of some algorithms for solving unconstrained linear approximation problems in the L sub I and L infinity norms is given. The extended algorithms allow lower or upper bounds to be placed on the parameters of the approximating function, while retaining the computational efficiency of the unconstrained algorithm. A representation of a cubic spline in terms of the values of its second derivatives at the knots and its value at the end of the range is derived. By placing simple non-negativity or non-positivity constraints upon the values of these derivatives the spline can be forced to satisfy prescribed properties such as local convexity or concavity. Author (ESRO)

N74-15306# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computing.
NUMERICAL QUADRATURE. A SURVEY OF AVAILABLE ALGORITHMS
Valerie A. Dixon (Oxford Univ.) Jun. 1973 46 p refs Sponsored by UKAEA
(NPL-NAC-36) Avail: NTIS HC $4.50

A survey of available algorithms is made which is divided into sections each of which deals with a particular type of integral. The integral may be defined over one or more dimensions, with finite, infinite or indefinite range and the integrand may be smooth, rapidly varying or singular. The available algorithms that implement the appropriate numerical methods of solution are considered and their performances on relevant examples are compared. Finally, the essential constituents of a versatile quadrature library are discussed. Author (ESRO)

N74-15307# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computing.
AVAILABLE ALGORITHMS FOR CURVE AND SURFACE FITTING
J. G. Hayes Jul. 1973 24 p refs Presented at the IMA Conf. on Software for Numerical Math., Loughborough, Engl., Apr. 1973
(NPL-NAC-39) Avail: NTIS HC $3.25

Available numerical algorithms for a wide range of curve and surface fitting problems are surveyed. Fitting in the least squares norm with both linear and nonlinear functions is included, with particular attention being paid to polynomial and spline curves and surfaces. Attention is also given to the question of imposing linear constraints on the solutions. ESRO

N74-15308# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computing.
A DATA-FITTING PACKAGE FOR THE NON-SPECIALIST USER
M. G. Cox Jul. 1973 28 p refs Submitted for publication
(NPL-NAC-40) Avail: NTIS HC $3.50

A polynomial and spline data-fitting package, written in the form of a suite of ALGOL 60 procedures, is described. The package includes algorithms for providing approximations to data which may be tabular, graphical, or mathematical. Also included are algorithms for evaluating, differentiating, and integrating the approximation concerned. ESRO

N74-15309# Eidgenossische Technische Hochschule, Zurich (Switzerland).
AN ITERATION THEORETICAL APPROACH TO THE CONCEPT OF TIME

Gyoergy Targonski 1973 6 p refs Presented at the Intern. Colloq. on Point Mapping and its Appl., Toulouse, 10-14 Sep. 1973; sponsored by the Lab. d'Autom. et d'Anal. des Systems of the CNRS
Avail: NTIS HC $3.00

Discrete time is defined through the semigroup generated by the mapping of a state space into itself. If this mapping has no inverse (irreversible transformation), the conventional group approach to time evolution fails and a semigroup approach has to be used. Embedding of the discrete semigroup in a continuous one leads to continuous time. The embedding is in general not unique, and different time flows arise. Generally, embedding in a continuous semigroup is not possible, and embedding in a largest possible discrete semigroup gives rise to a Chronon, smallest, indivisible, nonzero time interval. This construction is based on results obtained in previous investigations. The case of a differential equation, more precisely, a well-posed initial value problem, lends itself to discussion of the method. A functional equation concerning time scale transformation is also discussed. All problems outlined above can be formulated and discussed in terms of functional equations. Besides obvious applications in physics, applications in system theory are considered. Recent results and developments are discussed.
Author (ESRO)

N74-15310# Eidgenossische Technische Hochschule, Zurich (Switzerland).
OSCILLATIONS IN A CLASS OF PULSE CONTROL SYSTEMS
M. Mansour 1973 12 p refs Presented at the Intern. Colloq. on Point Mapping and its Appl., Toulouse, 10-14 Sep. 1973; sponsored by the Lab. d'Autom. et d'Anal. des Systemes of the CNRS
Avail: NTIS HC $3.00

Oscillations in sampled-data and pulse control systems were investigated using an analytical and an iteration method. It is shown that these methods are general and can be applied to systems of high order. Conditions of existence of these oscillations were derived.
Author (ESRO)

N74-15311# Centre National de la Recherche Scientifique, Toulouse (France). Lab. d'Automatique et d'Analyse des Systemes.
ON THE OBTENTION OF ENTIRE CREMONA TRANSFORMATIONS, OSCULATING AN ANALYTIC AREA-PRESERVING MAPPING [SUR L'OBTENTION DE TRANSFORMATIONS ENTIERES CREMONIENNES OSCULATRICES A UNE TRANSFORMATION PONCTUELLE ANALYTIQUE CONSERVANT LES AIRES]
L. Hsu and J. Bernussou 1973 10 p refs In FRENCH Presented at the Intern. Colloq. on Point Mapping and its Appl., Toulouse, 10-14 Sep. 1973; sponsored by the Lab. d'Autom. et d'Anal. des Systemes of the CNRS
Avail: NTIS HC $3.00

A method is proposed for the reduction of a dynamical problem to a point transformation (Poincare and Birkhoff method of the section surface). The method is implemented in two steps. First, an approximate truncated point transformation is found in, for example, the vicinity of a stationary point where series developments are possible. This transformation is in general nonconservative and the properties of the solution are not preserved. Second, high degree terms are added in such a way that the final transformation is a cremonian entire conservative, osculating the initial transformation. An applicative example is given.
ESRO

N74-15312# Centre National de la Recherche Scientifique, Toulouse (France). Lab. d'Automatique et d'Analyse des Systemes.
CLOSED INVARIANT CURVES OF NON-LINEAR RECURRENCE RELATIONSHIPS CLOSE TO A CONSERVATIVE LINEAR RECURRENCE OF THE SECOND ORDER [SUR LES COURBES INVARIANTES FERMEES DES RECURRENCES NON LINEAIRES VOISINES D'UNE RECURRENCE LINEAIRE CONSERVATIVE DU 2E ORDRE]
C. Mira 1973 13 p refs In FRENCH; ENGLISH summary Presented at the Intern. Colloq. on Point Mapping and its Appl., Toulouse, 10-14 Sep. 1973; sponsored by the Lab. d'Autom. et
Avail: NTIS HC $3.00

The study of some behaviors of a recurrent linear second order conservative system is presented. For small values of a parameter, an approximate formulation of invariant closed curves was obtained using a method similar to that of the Poincare small parameter method for differential equations. In a special case, certain bifurcations of an invariant closed curve in cycles were studied.
ESRO

N74-15313# Centre National de la Recherche Scientifique, Toulouse (France). Lab. d'Automatique et d'Analyse des Systemes.
SOME EXAMPLES OF BOUNDED STOCHASTIC SOLUTIONS OF THE AUTONOMOUS RECURRENCES OF THE SECOND ORDER [QUELQUES EXEMPLES DE SOLUTIONS STOCHASTIQUES BORNEES DANS LES RECURRENCES AUTONOMES DU 2E ORDRE]
J. Bernussou, L. Hsu, and C. Mira 1973 17 p refs In FRENCH; ENGLISH summary Presented at the Intern. Colloq. on Point Mapping and its Appl., Toulouse, 10-14 Sep. 1973; sponsored by the Lab. d'Autom. et d'Anal. des Systemes of the CNRS
Avail: NTIS HC $3.00

Some mechanisms of creation of bounded stochastic solutions corresponding to autonomous second order recurrences are presented. Three examples are given based on the conjecture that an annular stochastic zone of a conservative recurrence may transform itself in a variety of ways when the curves corresponding to unitary Jacobious cross the stochastic zone. The discussion is limited to: recurrences in the vicinity of a conservative recurrence with bounded nonlinearity; recurrence for which the stochastic zones appear after a bifurcation corresponding to an exceptional case for a double point of the initial recurrence; and for recurrences piecemeal differentiable and recurrences in the vicinity of such recurrences.
ESRO

N74-15314# Academy of Sciences of the Ukranian SSR, Kiev (USSR). Inst. of Cybernetics.
STABILITY AND DISSIPATIVITY OF ONE CLASS OF NONLINEAR SAMPLED-DATA CONTROL SYSTEMS
V. M. Kuntsevich and V. V. Volosov 1973 12 p refs Presented at the Intern. Colloq. on Point Mapping and its Appl., Toulouse, 10-14 Sep. 1973; sponsored by the Lab. d'Autom. et d'Anal. des Systemes of the CNRS
Avail: NTIS HC $3.00

A set of asymptotic stability or dissipation (limit boundedness) equalities for a wide class of nonlinear sampled data systems is presented. The equalities were obtained using the Lyapunov direct method with the help of Lagrange multipliers. The characteristics of a nonlinear sampled data system with a control coupling nonlinear equation are considered.
ESRO

N74-15315# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.
APPROXIMATE ANALYTIC METHODS FOR THE SOLUTION OF A CLASS OF STRONGLY NON-LINEAR DIFFERENTIAL EQUATIONS. A COMPARISON
Jean Ross and P. A. T. Christopher (Cranfield Inst. of Technol., Engl.) London Aeron. Res. Council 1973 34 p refs Supersedes ARC-33861
(ARC-R/M-3724; ARC-33861) Avail: NTIS HC $3.75; HMSO £1.25; PHI $4.90

A review was made of certain approximate analytic methods which are capable of solving a wide class of strongly nonlinear, ordinary, differential equations. Contained in this class are many equations which arise from the analysis of physical situations, as the equation of Van der Pol and the unforced Duffing equation. The relative accuracy of these methods was assessed by applying them to a particular strongly nonlinear equation and comparing the solutions with numerical solutions obtained on a digital computer. The results show the R.A.E. and CJ methods to be a useful and accurate means of solving this particular equation over a wide range of the coefficients involved.
Author (ESRO)

N74-15316# George Washington Univ., Washington, D.C. Program in Logistics.
SOME INEQUALITIES FOR CONCAVE FUNCTIONS OF

ORDER STATISTICS FROM IFR (INCREASING FAILURE RATE) DISTRIBUTIONS
Robert A. Brown and Nozer D. Singpurwalla 20 Sep. 1973 17 p refs
(Contract N00014-67-A-0214-0001; NR Proj. 437-020)
(AD-768033; Serial-T-290) Avail: NTIS CSCL 12/1

In the paper the authors consider functions which are the sum of the k largest order statistics in a sample of size n from a continuous distribution F, minus nh, where h is a specified constant. It is proven that such functions are concave in n. If F is an exponential distribution, then for a fixed k the authors obtain that value of n which maximizes the expected value of the function defined above. For F IFR an upper bound is obtained on n and also an upper bound on the maximum of the expected value of the function. Some other inequalities are also obtained. (Modified author abstract) GRA

N74-15317# Chicago Univ., Ill. Lab. for Atmospheric Probing.
ESTIMATION OF THE AVERAGE FREQUENCY OF A RANDOM PROCESS Ph.D. Thesis
John Joseph Herro May 1973 72 p refs Prepared in cooperation with Illinois Inst. of Tech., Chicago
(Contract N00014-67-A-0285-0014; NR Proj. 061-188)
(AD-768034; TR-31) Avail: NTIS CSCL 12/1

A means of estimating, in real time, the average frequency of a random process, is given only a time-limited sample of that process. The average frequency of a random process is defined in terms of the power spectral density. Previous estimators of average frequency were mathematically based on estimating the power spectral density. The average frequency is expressed in terms of the autocorrelation and cross correlation functions, and a new estimator is obtained which is based on estimates of these correlation functions. Expressions are obtained for the power spectral density and autocorrelation function at each point in the systems, exclusive of the outputs. Approximate expressions are obtained for the bias and variance of the proposed estimator and one of the referenced estimators. A lab model of the proposed device was constructed and tested under several sets of operating conditions. It is found that, under typical operating conditions, the proposed estimator performs almost as well as those proposed earlier, and is simpler in form. For very short samples of the random process, however, the difference in variance becomes more noticeable. Author (GRA)

N74-15318# Stanford Univ., Calif. Dept. of Computer Science.
NONLINEAR SPLINE FUNCTIONS
Michael A. Malcolm Jun. 1973 67 p refs
(Contract N00014-67-A-0112-0029; Grant NSF GJ-29988X)
(AD-767970; SU-STAN-CS-73-372) Avail: NTIS CSCL 12/1

A mathematical characterization of nonlinear interpolating spline curves is developed through a variational calculus approach, based on the Euler-Bernoulli large-deflection theory for the bending of thin beams or elastica. Algorithms previously used for computing discrete approximations of nonlinear interpolating splines are discussed and compared. The discrete natural cubic interpolating spline is discussed. An algorithm for computing discrete natural cubic splines is given and analyzed for discretization error and computational difficulty. Finally, a new algorithm together with its FORTRAN implementation is given for computing discrete nonlinear spline functions. Author (GRA)

N74-15319# Wisconsin Univ., Madison. Dept. of Statistics.
STATISTICAL MODELS FOR CONTROL, OPTIMIZATION, RELIABILITY, AND LIFE TESTING Annual Report, 1 Jun. 1972 - 31 May 1973
George E. P. Box and Grace Wahba 31 May 1973 8 p refs
(Grant AF-AFOSR-2363-72; AF Proj. 9769)
(AD-767105; AFOSR-73-1641TR) Avail: NTIS CSCL 12/1

The areas of research include topics of stochastic systems (especially with discrete control), statistical model building, the state variable approach, the effects of constraints on the degree of possible manipulation of a system, appropriate algorithms for optimal feed forward control, closed loop operations, discrete control and estimation, maximum likelihood estimation for the parameters of a dynamic model, estimation of the parameters in a stationary linear dynamic model, statistical analysis of the polynomial algorithm for probability density function estimation, estimation in non-linear systems, bounds for optimal mean square-error for probability density function estimation, density function estimation using interpolating spline functions, and the use of reproducing kernel Hilbert space techniques for the continuous time constrained control problems. Author (GRA)

N74-15320# Ohio State Univ., Columbus. Dept. of Geodetic Science.
STEPWISE AND SEQUENTIAL COLLOCATION
Helmut Moritz Jul. 1973 52 p refs
(Contract F19628-72-C-0120; AF Proj. 8607)
(AD-767314; DGS-203; AFCRL-TR-73-0432; SR-10) Avail: NTIS CSCL 12/1

In stepwise collocation, the estimation procedure is split up into two steps, corresponding to a partitioning of the covariance matrix to be inverted. Formulas for signal and parameter estimates and for their error covariances are derived and interpreted statistically. Stepwise adjustment by parameters and by conditions is exhibited as special cases of stepwise collocation. Sequential collocation is an extension of the procedure so as to comprise several steps. Finally, the relation between sequential collocation and Kalman filtering is considered in some detail. Author (GRA)

N74-15615 Chantiers de l'Atlantique Saint-Nazaire (France).
THE DOUBLE ITERATION METHOD IN STRUCTURAL OPTIMIZATION
Daniel H. Finifter *In* AGARD Second Symp. on Structural Optimization Nov. 1973 10 p refs (For availability see N74-15596 06-32)

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N74-15321 British Library Lending Div., Boston Spa (England).
THE BLOCKING SITUATION IN THE FRAME-WORK OF THE EURO-ATLANTIC CIRCULATION WITH PARTICULAR REFERENCE TO THE EUROPE-MEDITERRANEAN REGION
M. Montalto, M. Conte, and M. Urbani [1972] 41 p refs Transl. into ENGLISH from Riv. Met. Aero. (Rome), v. 32, 1972 p 119-132 In ENGLISH and ITALIAN
(BLL-M-23106-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 4 BLL photocopy coupons

On examining the geographical distribution over areas arbitrarily pre-selected in the Euro-Atlantic region of days affected by blocking action in the circulation during the period 1951 to 1970, it was found that the characteristic features of blocking do not depend on the geography of the area examined. The existence is suggested of factors intrinsic to the blocking system phenomenon itself. Making use of a previous classification of types of weather over central and southern Europe, some significant associations were found to exist between certain types of circulation and blocking systems during the initial, developmental, and collapse stages. Evidence is given for the singular nature of blocking systems that show a tendency to give rise, during their developmental phase, to types of weather over the Europe-Mediterranean region which are singular.
Author

N74-15322 British Library Lending Div., Boston Spa (England).
LOW JET STREAMS OVER CENTRAL EUROPE
D. Podhorsky [1973] 26 p refs Transl. into ENGLISH from Zbor Prac Hydromet Ustav (Bratislava), 1972 p 179-193 In ENGLISH and RUSSIAN
(BLL-M-23110-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 3 BLL photocopy coupons

After an analysis of the present state of research into the low level jet stream (LLJ) abroad, the spatial features of the LLJ over Central Europe are presented for the period 1957-1966. Some of the ideas of BONNER, ESBENSON, and GREENBERG are applied. In determining the structure of the LLJ, 15 representative instances falling into 3 groups were chosen: western, southern and northwestern. For each group the coordinate

system was built around the axis of the jet stream. For individual points of a given system the mean speeds of the observed and geostrophic winds were calculated and plotted on an isotach chart. Author

N74-15323 British Library Lending Div., Boston Spa (England).
THE INFLUENCE OF THE MOON ON DRY AND WET PERIODS
A. Gabilly [1973] 19 p refs Transl. into ENGLISH from Met. (Paris), no. 12, 1969 p 67-75 In ENGLISH and FRENCH
(BLL-M-23107-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

The beginning or ending of dry or wet periods of at least three days of duration was investigated for lunar influences. Data from 1944 to 1964 was used in the study. Criteria for the confidence limits of the frequencies, and means are discussed along with the duration of the periods and their tendency to persist. It is concluded that a higher probability of persistance for periods of 10 days or more is indicated than for shorter period of three days. F.O.S.

N74-15324 Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie.
METEOROLOGICAL DATA. VOLUME 139, NO. 1: THE EUROPEAN CLIMATOLOGY 1973. WEATHER SATELLITE DATA FROM THE BERLIN ZONE OF RECEPTION, PART 1 [METEOROLOGISCHE ABHANDLUNGEN. BAND 139, HEFT I: DAS EUROPAEISCHE WETTERBILD 1973. WETTERSATELLITEN-DATEN AUS DEM BERLINER EMPFANGSBEREICH. TEIL I, 1. VIERTELJAHR]
1973 204 p refs In GERMAN
Avail: Issuing Activity

ESSA 8 and NOAA 2 photographic maps of the European continent are interpreted for their cloud formations and snow field distributions during the first quarter in 1973.
Transl. by G.G.

N74-15325 Indiana Univ., Bloomington.
SPATIAL VARIATION OF RAINFALL SPECTRA IN EASTERN UNITED STATES Ph.D. Thesis
Noman Abed Shehadeh 1973 133 p
Avail: Univ. Microfilms Order No. 73-23032

The temporal and spatial fluctuations in precipitation over the eastern United States was investigated. Power spectrum analysis is used to establish the general shape of rainfall spectra. Cross-spectral analysis is used to investigate the spatial association of the most important rainfall fluctuations. Results suggest that daily rainfall distribution in the midwest and northeastern states is characterized by a 7.5 to 10 day quasi-periodicity. A quasi-periodicity of 6 to 7.5 days characterizes daily rainfall distribution in winter while a 10 day quasi-periodicity characterizes daily rainfall distribution in summer. Daily rainfall distribution in part of the Tennessee Valley and the Mississippi embayment does not show any significant fluctuations. Winter rainfall in the southeastern coastal plain is characterized by a marked 14.765 day periodicity. Dissert. Abstr.

N74-15326 Oklahoma Univ., Norman.
AN URBAN AIR POLLUTION PREDICTION MODEL BASED ON DEMOGRAPHIC PARAMETERS Ph.D. Thesis
John Wesley Carter, Jr. 1973 169 p
Avail: Univ. Microfilms Order No. 73-23933

The statistical correlations between the regression of demographic and emissions data were used to construct a model to predict future air pollution emissions, concentrations, and cross-to-control based on demographic data inputs from a population model. Correlations were run for 23 cities ranging in population from 40 thousand to 2 million. These correlations are between total pollutant emissions and the demographic factors of population, number of passenger vehicles registered in the county, and the percent of the work force employed in manufacturing. Land area is used to utilize the emissions on a top per square mile per year basis. Using these correlations to describe cities of increasing size and age, a linear modeling technique is used to describe the future air pollution emissions in a growing city, either on a geographical or a population-industrial growth pattern. Since the probability that the emissions of a growing city will fall precisely on the regression line is low, the model provides that measured emission values may be substituted to establish a more representative regression for that city.
Dissert. Abstr.

N74-15327 Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie.
METEOROLOGICAL DATA. VOLUME 135, NO. 6: RESULTS OF THE SYNOPTIC SERVICE DURING 1973. DAILY AND MONTHLY WEATHER MAPS (GROUND, 500 mb), TABLES AND BRIEF SCIENTIFIC ARTICLES, JUNE [METEOROLOGISCHE ABHANDLUNGEN. BAND 135, HEFT 6: ERGEBNISSE DES SYNOPTISCHEN DIENSTES IM JAHRE 1973. TAEGLICHE UND MONATLICHE WETTERKARTEN (BODEN, 500mb), TABELLEN UND KLEINERE WISSENSCHAFTLICHE AUFSAETZE, JUNI]
1973 174 p In GERMAN
Avail: Issuing Activity

Daily and monthly Northern Hemisphere ground level and 500 mb height and temperature analyses of constant pressure levels for June, 1973, are presented based on rawinsonde and atmospheric rocket sounding data. Corresponding mean maps, their variations and deviations are included as well as the mean gridpoint data calculated from daily values. Included scientific studies cover climatological parameters of the Berlin vicinity, including fog, storm and squall line formations. Transl. by G.G.

N74-15328 Wyoming Univ., Laramie.
METEOROLOGICAL CHARACTERISTICS OVER THE GRASSLAND BIOME'S PAWNEE SITE Ph.D. Thesis
John R. Nunn 1973 166 p
Avail: Univ. Microfilms Order No 73-25561

A data acquisition system was designed and constructed for securing meteorological data on a simultaneous and continuous basis at the Pawnee Site of the Grassland Biome. Meteorological transducers, system calibration procedures, and data reduction techniques are described. Temperature, radiation, and wind speed characteristics for two grazing treatments are included. An informatic meteorological data availability chart was developed for 1970 and 1971. A method for estimating net radiation from solar radiation by regression was developed. Evaporation rates from nongrazed and heavily grazed treatments were explained by plant phenology and canopy resistance.
Dissert. Abstr.

N74-15329# Scientific Translation Service, Santa Barbara, Calif.
ESTIMATION OF ATMOSPHERIC TURBIDITY ON THE BASIS OF ACTINOMETRIC DATA
Ye. N. Rusina 1973 13 p refs Transl. into ENGLISH from the publ "Atmospheric Diffusion and Air Pollution" Leningrad, Hydrometeorol., 1971 p 190-197 Sponsored by EPA
(APTIC-47362; TR-647-73-P) Avail: NTIS HC $3.00

The distribution of atmospheric turbidity over the U.S.S.R. is described along with the actinometer method for estimating the degree of atmospheric pollution in cities. It is shown that the turbity decreases with increasing latitude, and the annual pattern of turbity is discussed for several cities. It is concluded that on the basis of the climatic norms for direct solar radiation with a clear sky, atmospheric turbity can be used as a standard for estimating the degree of pollution of individual regions, and the degree of dustiness of the atmosphere in cities may be estimated using actinometric observations at urban and suburban stations. F.O.S.

N74-15330# Scientific Translation Service, Santa Barbara, Calif.
PULSATIONS IN WIND DIRECTION IN THE BOUNDARY LAYER OF THE ATMOSPHERE
A. S. Zaytsev and M. Ye. Berlyand, ed. 1971 7 p refs Transl. into ENGLISH from the publ. "Atmospheric Diffusion and Air Pollution" Leningrad, Hydrometeorological Press, 1971 p 100-103 Sponsored by EPA
(APTIC-48307; TR-647-73F) Avail: NTIS HC $3.00

An analysis was made of pibal collected data on wind direction pulsations. The reported findings include the following: (1) During the morning and evening hours the changes in wind direction

are not great, are relatively constant with altitude, and are characterized on the average by values on the order of 8 to 10 degrees. (2) In the hours before noon, there is a significant increase in the pulsations of wind direction in the lower part of the boundary layer of the atmosphere. (3) During the hours after noon, intensive turbulent exchange affects large layers, and the wind speed throughout the boundary layer increases. The vertical profile becomes less evident, the variance values reach their maxima, and the stratification of the boundary layer becomes clearly evident, forming individual layers. (4) The dependence of the variation in wind direction on wind speed showed a clear decrease in the average deviation with increasing wind speed.
D.L.G.

N74-15331# Scientific Translation Service, Santa Barbara, Calif.
TESTING A METHOD OF CALCULATING ATMOSPHERIC DISPERSION OF COLD EMISSIONS, BASED ON INVESTIGATIVE DATA FROM SYNTHETIC FIBER ENTERPRISES
B. K. Baykoov, R. S. Gildenskiold, I. M. Zrazhevskiy, R. I. Onikul, G. A. Panfilova, and M. YE. Berlyand, ed. 1971 16 p refs Transl. into ENGLISH from the publ. "Atmospheric Diffusion and Air Pollution" Leningrad, Hydrometeorological Press, 1971 p 72-81 Sponsored by EPA
(APTIC-47947; TR-647-73C) Avail: NTIS HC $3.00

The research to expand the applicability of the standard method for calculating the dispersion of industrial emission in the atmosphere is reported. The calculations are simplified by attributing average source values to a single source of emission. Emissions are characterized for areas one to two kilometers from the industrial area. The plume distribution of the calculated concentration of carbon disulfide for the Balakova fiber plants is presented along with comparisons of measured and calculated concentrations. F.O.S.

N74-15332# Rima (Alessandro), Muralto (Switzerland).
REPORT ON THE NUMBER OF TROPICAL CYCLONES OBSERVED OVER WESTERN AUSTRALIA (1889 - 1969) [NOTA SUL NUMERO DEI CICLONI TROPICALI OSSERVATI SULL'AUSTRALIA OCCIDENTALE (1889 - 1969)]
Alessandro Rima Jan. 1972 25 p refs In ITALIAN Sponsored by Western Australia Univ.
(Ri/cd/30) Avail: NTIS HC $3.25

Statistical data on the occurrence of tropical cyclones are analyzed for Western Australia. The periodic cycles and influence on precipitation are discussed. Transl. by F.O.S.

N74-15333# Deutscher Wetterdienst, Offenbach am Main (West Germany).
THE DEVELOPMENT OF METEOROLOGICAL OBSERVATIONS IN FRANCONIA AND BAVARIA UP TO 1700 [DIE ENTWICKLUNG DER METEOROLOGISCHEN BEOBACHTUNGEN IN FRANKEN UND BAYERN BIS 1700]
Fritz Klemm 1973 49 p refs In GERMAN
(Rept-8) Avail: NTIS HC $4.50

A chronological history of the meteorological reporting activities in Franconia and Bavaria for the time period between 1331 and 1700 is presented. The individuals and the locations of the weather stations for given time periods are identified. Samples of weather reports are provided to show the simple nature of the observations. The supposed effect of the relative location of the planets on weather conditions is analyzed. A bibliography of 125 documents concerning meteorology showing the author, year, and location of the observations is included.
Transl. by P.N.F.

N74-15334# Centre Meteorologique Regional de Marignane (France).
NORTH, WEST, AND NORTHWEST WINDS OF MARSEILLES FROM 1882 TO 1970 (STATISTICAL ANALYSIS) [VENTS DE NORD-OUEST ET MISTRAL A MARSEILLE DE 1882 A 1970 (ESSAI STATISTIQUE)]
C. Bordreuil, A. Barbia, and P. Comte Sep. 1973 39 p refs In FRENCH
(Monograph-88) Avail: NTIS HC $4.00

A statistical analysis was made of the north, west, and northwest winds of Marseilles from 1882 to 1970. Data cover variations as a result of annual precipitation, temperature, and microclimatology. Results are given in tabular form.
Transl. by E.H.W.

N74-15335# Kyoto Univ. (Japan).
USING WIND TUNNEL EXPERIMENTS TO FORECAST AUTOMOBILE EXHAUST GAS CONCENTRATIONS ALONG STREETS
T. Odaira, K. Asakuno, S. Fukuoka, M. Udagawa, S. Izumikawa, M. Funeshima, M. Ito, H. Yokota, K. Nishida, and T. Yamamoto [1973] 20 p refs
(APTIC-57002; TR-38A-74) Avail: NTIS HC $3.00

The applicability of wind tunnel experiments to forecasting the concentration of automobile exhausts near streets is discussed. Scale models of various street intersections were used in the experiments. It was found that air pockets are formed in the wind tunnel as the wind tunnel deals with a steady state, while no air pockets are formed in the field as the wind is constantly changing. It is concluded that although forecasting from wind tunnel experiments is more effective than other methods, numerous problems remain to be solved. F.O.S.

N74-15336# Tokyo Metropolitan Research Inst. for Environmental Protection (Japan).
DAMAGE TO VEGETATION WHEN EXPOSED TO OZONE AND HIGH OXIDANT CONCENTRATIONS Annual Report
T. Odaira, T. Sawada, T. Komeiji, I. Nouchi, K. Oguchi, K. Negishi, M. Iwanami, and T. Asaka 1973 12 p refs
(TR-38B-74) Avail: NTIS HC $3.00

In order to examine the damage to outdoor plants at high oxidant times, some specimens each from herbaceous and woody plants were exposed to ozone, and the results were as follows. In these tests 15 herbaceous species were used, including Brassica rapa and B. pekinensis, while 8 different woody plant species were employed, including Zelkova serrata and cherry tree. (1) Woody plants are in general more resistant to ozone than are herbaceous plants. (2) Among herbaceous plants, soybean and alfafa form a group of weaker resistance; cauliflower, Welsh onion, and corn had stronger resistance; leaf lettuce, cucumber, kidney bean, carrot, tomato, and petunia were in an intermediate group. (3) As far as the resistance of woody plants is concerned, poplar has been found to be the weakest, followed by the cherry tree and platanus, while Kelkova serrata proved stronger and deodar and maidenhair tree stronger yet. (4) The most conspicuous leaf injury symptoms for herbaceous plants were leaf specks on the bleaching-type. (5) Leaf injury symptoms for woody plants showed up in the dark brown or red-brownish flecks on full-grown trees. Author

N74-15337# Scientific Translation Service, Santa Barbara, Calif.
EXTENSION OF THE THEORY OF DIFFUSION OF INDUSTRIAL EMISSIONS INTO THE ATMOSPHERE
M. Ye. Berlyand, ed. and R. I. Onikul 1971 44 p refs Transl. into ENGLISH from the publ. "Atmosfernaya Diffuziya i Zagryazneniye Vozdukha" Leningrad, Hydrometeorological Press, 1971 p 1-38 Sponsored by EPA
(APTIC-48174; TR-647-73) Avail: NTIS HC $4.25

The results of theoretical and experimental studies of turbulent diffusion of pollutants, and pollution of the air by industrial emissions are presented. The consideration of meteorological factors in the planning and operation of factories is discussed as well as organization and methods of air pollution observation. Author

N74-15338# Joint Publications Research Service, Arlington, Va.
METEOROLOGY AND HYDROLOGY NO. 9, 1973
14 Dec. 1973 129 p refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 9, 1973 p 3-68, 80-110
(JPRS-60787) Avail: NTIS HC $8.50

Articles are presented on microclimate, agriculture meteorology, weather forecasting and climate control, and hydrological forecasting. For individual titles, see N74-15339 through N74-15346.

N74-15339 Joint Publications Research Service, Arlington, Va.
MODERN CLIMATE VARIATIONS
M. I. Budyko and K. Ya. Vinnikov *In its* Meteorology and Hydrology

no. 9, 1973 (JPRS-60787) 14 Dec. 1973 p 1-13 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 9, 1973 p 3-13 (For availability see N74-15338 06-20)

The analysis of the secular course of transparency of the atmosphere, the thermal regime, and the hydrologic cycle for the extraequatorial zone of the Northern Hemisphere shows that over the greater part of the last century the primary factor determining the variations in climatic conditions was the fluctuations of the aerosol concentration in the lower stratosphere and the variations in the total solar radiation connected with them. During the last two or three decades, the anthropogenic factors have begun to have a noticeable effect. Author

N74-15340 Joint Publications Research Service, Arlington, Va.
SOME CHARACTERISTIC FEATURES OF WIND CYCLICITY IN THE EQUATORIAL STRATOSPHERE
Kh. P. Pogosyan *In its* Meteorology and Hydrology no. 9, 1973 (JPRS-60787) 14 Dec. 1973 p 14-28 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 9, 1973 p 14-26 (For availability see N74-15338 06-20)

The results of studying the quasibiannual cyclicity of the wind in the equatorial stratosphere are discussed. The hypothesis of the occurrence of a westerly phase of the cycle is proposed, and the global nature of this phenomenon is defined. No direct relation was discovered between the westerly winds in the lower and upper stratosphere. The westerly winds occur on attenuation of the meridional processes on the earth as a result of which in high latitudes there is a reduction in the air temperature, and in low latitudes, on the contrary, an increase in it in the upper troposphere and lower stratosphere. The latter also causes the occurrence of westerly winds in the equatorial stratosphere. The cyclicity of the oscillation of the meridional nature of the circulation obviously is characteristic for atmosphere processes. Author

N74-15341 Joint Publications Research Service, Arlington, Va.
PROCESS OF DETERMINATION OF A SOLUTION IN LONG RANGE NUMERICAL INTEGRATION OF THE EQUATIONS OF PLANETARY DYNAMICS OF THE ATMOSPHERE
V. A. Yefimov *In its* Meteorology and Hydrology no. 9, 1973 (JPRS-60787) 14 Dec. 1973 p 29-44 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 9, 1973 p 27-39 (For availability see N74-15338 06-20)

The principles of solving the problem of obtaining the equilibrium state based on the mathematical model of atmospheric circulation are discussed. Special attention is given to the observation of the balance of the energy sources and outflows introduced into the model, including the balance between the processes with negative and positive viscosity. The discussed integration principles are illustrated by the calculations of certain characteristics of motion. A study was made of the algorithm for the solution of the equations of dynamics of the atmosphere in the tropical belt, the processes of which are simulated jointly with the processes in the Northern and Southern Hemispheres. Author

N74-15342 Joint Publications Research Service, Arlington, Va.
SOME PROBLEMS OF SOLAR-ATMOSPHERIC RELATIONS
V. M. Zadvernyuk and V. V. Mikhnevich *In its* Meteorology and Hydrology no. 9, 1973 (JPRS-60787) 14 Dec. 1973 p 45-53 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 9, 1973 p 40-47 (For availability see N74-15338 06-20)

A study was made of the correlation of disturbances in the illuminated and unilluminated atmosphere at altitudes of 10 to 60 km (middle latitudes) with geomagnetic disturbances. The reaction of the atmosphere to violent solar flares accompanied and not accompanied by geomagnetic disturbances is analyzed. Author

N74-15343 Joint Publications Research Service, Arlington, Va.
POSSIBILITY OF MAPPING THE ICE SITUATION ON LARGE LAKES BY PHOTOGRAPHS FROM ARTIFICIAL EARTH SATELLITES **c13**
V. G. Prokacheva *In its* Meteorology and Hydrology no. 9, 1973 (JPRS-60787) 14 Dec. 1973 p 54-62 refs Transl. into ENGLISH from Meteorol. i Gidrol (Moscow), no. 9, 1973 p 48-55 (For availability see N74-15338 06-20)

A discussion is presented on the possibility of using televised information from the meteor meteorological artificial earth satellite to obtain information about the ice conditions of large lakes. A comparison of the synchronous cartograms of the air ice reconnaissance of Ladoga Lake and the ice situation according to the television image from the meteor satellite demonstrated their good compatibility and the possibility of obtaining the basic characteristics of the winter conditions of the lake by the television images. The basic decoding attributes of the lake ice objects for the television images from the meteor satellite having a resolution on the order of 1 to 2 km were established. A procedure was proposed for constructing the ice cartograms by the television image. By this procedure, 5 cartograms of the ice situation were compiled for Ladoga Lake in the winter-spring period of 1971. Author

N74-15344 Joint Publications Research Service, Arlington, Va.
ADDITIONAL DATA FOR SHORT-RANGE WEATHER FORECASTING
A. I. Snitkovskiy *In its* Meteorology and Hydrology no. 9, 1973 (JPRS-60787) 14 Dec. 1973 p 63-67 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 9, 1973 p 66-68 (For availability see N74-15338 06-20)

It is proposed that a new 900 millibar isobaric surface be introduced into synoptic practice. This will offer the possibility of developing more reliable methods of forecasting atmospheric phenomena: (1) improvement of the storm wind forecast with a short lead time, (2) evaluation of the displacement of air particles in the lower layer of the troposphere in order to have more correct determination of the stratification curve and the state, and (3) use of reliable information in the theoretical models of the boundary layer. Author

N74-15345 Joint Publications Research Service, Arlington, Va.
HYDRODYNAMIC STUDIES OF TROPICAL ATMOSPHERIC CIRCULATION AND LOW-LATITUDE NUMERICAL FORECASTING
I. G. Sitnikov *In its* Meteorology and Hydrology no. 9, 1973 (JPRS-60787) 14 Dec. 1973 p 68-89 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 9, 1973 p 80-92 (For availability see N74-15338 06-20)

A survey is made of the hydrodynamic studies of the tropical and equatorial atmosphere. In particular, the general problems of dynamics, the problems parameterization of the phenomena on a scale smaller than the stepsize of the grid, simulation of zonal circulation at the equator and the intratropical zone of convergence, and numerical experiments with respect to general atmospheric circulation in those aspects which pertain to the tropics were analyzed. A number of the problems discussed are connected with the numerical forecasting in the lower latitudes, including the problem of the initial data for forecasting schemes. The role of GARP, Atlantic Tropical Experiment, in the solution of the problems of dynamics and forecasting in the tropics is discussed. Author

N74-15346 Joint Publications Research Service, Arlington, Va.
SOLAR CYCLES AND CLIMATE
S. P. Khromov *In its* Meteorology and Hydrology no. 9, 1973 (JPRS-60787) 14 Dec. 1973 p 90-124 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 9, 1973 p 93-110 (For availability see N74-15338 06-20)

Some disputed questions pertaining to the cyclicity of solar activity and its proposed relations to the climate are examined. Author

N74-15347*# General Dynamics/Convair, San Diego, Calif. Aerospace Div.
AIR POLLUTION MEASUREMENTS FROM SATELLITES
C. B. Ludwig, M. Griggs, W. Malkmus, and E. R. Bartle Washington NASA Nov. 1973 224 p refs
(Contract NAS1-10466)
(NASA-CR-2324; GDCA-HAB-73-011) Avail: NTIS HC $5.50 CSCL 04B

A study is presented on the remote sensing of gaseous and particulate air pollutants which is an extension of a previous report. Pollutants can be observed by either active or passive remote sensing systems. Calculations discussed herein indicate that tropospheric CO, CO2, SO2, NO2, NH3, HCHO, and CH4 can be measured by means of nadir looking passive systems.

Additional species such as NO, HNO3, O3, and H2O may be measured in the stratosphere through a horizon experiment. A brief theoretical overview of resonance Raman scattering and resonance fluorescence is given. It is found that radiance measurements are most promising for general global applications, and that stratospheric aerosols may be measured using a sun occultation technique. The instrumentation requirements for both active and passive systems are examined and various instruments now under development are described. Author

N74-15348*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A RADIOSONDE THERMAL SENSOR TECHNIQUE FOR MEASUREMENT OF ATMOSPHERIC TURBULENCE
Jack L. Bufton Nov. 1973 45 p refs
(NASA-TM-X-70556; X-524-73-365) Avail: NTIS HC $4.25 CSCL 04B

A system was developed to measure vertical profiles of microthermal turbulence in the free atmosphere. It combines thermal sensor technology with radiosonde balloon systems. The resultant data set from each thermosonde flight is a profile of the strength and distribution of microthermal fluctuations which act as tracers for turbulence. The optical strength of this turbulence is computed and used to predict optical and laser beam propagation statistics. A description of the flight payload, examples of turbulence profiles and comparison with simultaneous stellar observations are included. Author

N74-15349# Advisory Group for Aerospace Research and Development, Paris (France).
TECHNICAL EVALUATION REPORT ON AGARD TECHNICAL MEETING ON ATMOSPHERIC POLLUTION BY AIRCRAFT ENGINES
Paul A. Libby (Calif. Univ., La Jolla) Nov. 1973 6 p Presented at the Proc. of the Propulsion and Energetics Panel 41st Meeting, Regent's Park, Engl., 9-13 Apr. 1973
(AGARD-AR-63; AGARD-CP-125) Avail: NTIS HC $3.00

The environmental problems associated with aircraft operations are discussed. Emphasis is placed on the general problem of air pollution in the neighborhood of airports due to aircraft engine exhaust products. The anticipated benefits from basic combustion research for reducing the pollutants in aircraft engine exhaust are examined. The necessity to determine the amount of pollution caused by aircraft engines as compared with vehicular traffic and adverse meteorological conditions as a basis for cost effective propulsion system modifications is stressed. Author

N74-15350*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DATA FOR FIRST NASA ATMOSPHERIC VARIABILITY EXPERIMENT (AVE 1). PART 1: DATA TABULATION
James R. Scoggins (Texas A and M Univ.) and Orvel E. Smith Dec. 1973 684 p refs
(Contract NAS8-26751)
(NASA-TM-X-2938) Avail: NTIS HC $12.75 CSCL 04B

A tablulation is given of rawinsonde data for NASA's first Atmospheric Variability Experiment (AVE 1) conducted during the period February 19-22, 1964. Methods of data handling and processing, and estimates of error magnitudes are also given. Data taken on the AVE 1 project in 1964 enabled an analysis of a large sector of the eastern United States on a fine resolution time scale. This experiment was run in February 1964, and data were collected as a wave developed in the East Gulf on a frontal system which extended through the eastern part of the United States. The primary objective of AVE 1 was to investigate the variability of parameters in space and over time intervals of three hours, and to integrate the results into NASA programs which require this type of information. The results presented are those from one approach, and represent only a portion of the total research effort that can be accomplished. Author

N74-15351# RAND Corp., Santa Monica, Calif.
THE STATISTICAL ANALYSIS OF SIMULATED CLIMATIC CHANGE
Michael Warshaw Sep. 1973 101 p refs
(Contract DOT-OS-30044)
(R-1298-DOT) Avail: NTIS HC $7.25

A method is presented of comparing simulations of the global atmosphere and determining, by statistical hypothesis testing, if selected meteorological properties of the simulations are significantly different. The primary concern of the CIAP program is the prediction of possible climatic change when some part of the physical stratosphere is altered. It becomes crucial, then, to guard against claiming a causal connection between observed change and the simulated change in the stratosphere when the observed change was only an acceptable random deviation of the unperturbed atmospheric system. All this, and the required tests for independence, are incorporated into an on-line, interactive computer program which guides the investigator through the maze of sequential decisions required to perform a fair statistical test while giving away as little data as possible. The mathematics of the testing procedures and transformations are presented, followed by instructions for use of the program that implements these tests. Appendixes give the program flow chart, examples of usage, and FORTRAN source listings. Author

N74-15352# Battelle-Northwest, Richland, Wash. Atmospheric Sciences Program.
[ATMOSPHERIC POLLUTION FORM ENERGY PRODUCTION] Annual Report, 1972. Volume 2: Physical Sciences. Part 1: Atmospheric sciences
C. L. Simpson Apr. 1973 162 p refs
(Contract AT(45-1)-1830)
(BNWL-1751-Pt-1) Avail: NTIS

Environmental considerations associated with energy production are explored, specifically the processes which transport, dilute, and deposit energy associated pollutants in the atmospheric boundary layer. Research reported in this area includes: (1) influence of soil resuspension on the airborne particle size distribution; (2) fractional airborne release of radioactivity during the burning of contaminated solvents; (3) dry deposition process; (4) spectral transfer functions for a three-component sonic anemometer; (5) aircraft instrumentation for the measurement of turbulent wind fluctuation; (6) snow scavenging of lead particulates; and (7) tracer studies in the metropolitan meteorological experiment. K.M.M.

N74-15353# Michigan Univ., Ann Arbor.
RAIN SCAVENGING STUDIES Progress Report
A. Nelson Dingle Jul. 1973 123 p refs
(Contract AT(11-1)-1407)
(COO-1407-49; PR-9) Avail: NTIS HC $8.25

Meteorological factors that influence the transport and deposition of NaI particles following release for cloud modification in the vicinity of frontal storms in central Illinois are discussed in relation to rain scavenging. Rainwater samples collected over a large area were analyzed to determine the amounts and rates of Pb deposition by rain. A mathematical model of contaminant scavenging by precipitation is presented and the parameters introduced into this model are evaluated in accordance with well known physical processes that take into account particle and droplet size spectra. The performance of an air sampler is discussed in relation to the formation growth of (NH4)2SO4 crystals during use. Author (NSA)

N74-15354# Stockholm Univ. (Sweden). Inst. of Meteorology.
RESIDENCE TIME OF ATMOSPHERIC POLLUTANTS AS DEPENDENT ON SOURCE CHARACTERISTICS, ATMOSPHERIC DIFFUSION PROCESSES AND SINK MECHANISMS
Bert Bolin, Goeran Aspling, and Christer Persson May 1973 29 p refs
(AC-25) Avail: NTIS HC $3.50

A brief discussion of the sink mechanisms of atmospheric pollutants is given and particular emphasis is given to the importance of rain-out (wash-out) and dry deposition. The turbulent transfer processes that determine the latter are analyzed in the light of the classical theory for the atmospheric surface boundary layer. The transfer rates to the free atmosphere (where rain-out and wash-out are the sink mechanisms) and to the earth's surface (when dry deposition occurs) are computed as dependant on height of emission, roughness of the earth's surface, deposition velocity at the earth's surface, and the intensity of the turbulent processes as dependent on wind velocity. On the basis of such computations the residence time of atmospheric pollutants can

be computed. The relative importance of rain-out (wash-out) and dry deposition in this regard is also discussed. Author (ESRO)

N74-15355# European Space Research Organization, Paris (France).
WORLDWIDE COORDINATION OF GEOSTATIONARY METEOROLOGICAL SATELLITE SYSTEMS [LA COORDINATION A L'ECHELLE MONDIALE DES SYSTEMES DE SATELLITES METEOROLOGIQUES GEOSTATIONNAIRES]
J. P. Contzen 1973 8 p In FRENCH Presented at the Intern. Symp. on Meteorol. Satellites, Paris, 21-24 May 1973
Avail: NTIS HC $3.00

Standardization and normalization aspects on the geostationary meteorological satellites system that will form part of the Global Atmospheric Research Program, are discussed. Coordination in the development of American, European, Japanese, and Russian meteorological satellites is stressed. The configuration of the worldwide satellite system is described. Recommendations on the 2000 data collection platforms ultimately to be used are given. The automatic picture transmission techniques APT and WEFAX are detailed, and the storing problems of the data to be produced by the satellites are discussed. ESRO

N74-15356# Institut Royal Meteorologique de Belgique, Brussels.
THE WEATHER IN 1972 [LE TEMPS EN 1972]
R. Sneyers 1973 54 p In FRENCH
(Publ-Ser-B-72) Avail: NTIS HC $4.75

A climatological study in Belgium for the period December 1971 through November 1972 is presented with accompanying graphical and tabular data. Among the topics discussed are the general atmospheric situation, winds, haze and insolation, air humidity and precipitation. The predominant influences characterizing the weather in each month are also described. ESRO

N74-15357# Institut Royal Meteorologique de Belgique, Brussels.
ADIABATIC AND ISOBARIC MIXING OF AIR MASSES [ADIABATISCHE EN ISOBARISCHE MENGING VAN LUCHTMASSA'S]
E. DeDycker and L. Dufour 1973 22 p refs In DUTCH
(Publ-Ser-B-73) Avail: NTIS HC $3.25

The first law of thermodynamics for closed polythermic systems was applied to the adiabatic and isobaric mixing of two masses of humid air. Formulas were derived permitting calculations of temperature and composition of the mixture for cases in which the two masses contain liquid water. From these formulas, approximation formulas were drawn up, also permitting graphical interpretation of the results. Various cases were investigated, among which were the mixing of two humid but not saturated masses of air. Numerical examples are given, showing that the amount of liquid water present in the mixture is of the same magnitude as for fog. ESRO

N74-15358# World Meteorological Organization, Geneva (Switzerland).
COMPARISON BETWEEN PAN AND LAKE EVAPORATION
C. E. Hounam 1973 61 p refs
(WMO-354; TN-126) Avail: NTIS HC $5.26; WMO, Geneva

The most important types of evaporimeters in use are described and details of their construction and advice on their use are given. The factors having an influence on pan and lake evaporation are discussed particularly in relation to the various coefficients that have been developed for converting the evaporator rates from pans and tanks to estimates of lake evaporation. These coefficients vary significantly in space, in time, and in relation to the particular characteristics of the lake in question, a description is given of the methods that have been proposed for correcting them so as to eliminate the effects of such variations. ESRO

N74-15359# Research Triangle Inst., Durham, N.C.
COMPREHENSIVE STUDY OF SPECIFIED AIR POLLUTION SOURCES TO ASSESS THE ECONOMIC IMPACT OF AIR QUALITY STANDARDS, VOLUME 1 Final Report
David A. LeSourd and F. L. Bunyard Aug. 1972 377 p refs
(Contract EPA-68-02-0088)
(PB-222857/5; RTI-FR-41U-649-Vol-1; APTD-1547) Avail: NTIS HC $8.00 CSCL 13B

Estimates are provided for emissions, control costs, and economic impact on a national basis for mobile sources, solid waste disposal, stationary fuel combustion and 19 industrial processes sources. The pollutants from mobile sources selected for analysis are hydrocarbons, carbon monoxide, and nitrogen oxides. Three general classes of stationary sources are considered; solid waste disposal, stationary fuel combustion, and industrial processes. Industrial processes sources studied are: asphalt batching, cement, coal cleaning, grain plants, gray iron foundries, iron and steel, kraft (sulfate) pulp, lime nitric acid, petroleum products and storage, petroleum refineries, phosphate, copper, lead, zinc, aluminum, secondary nonferrous metallurgy, and sulfur acid. GRA

N74-15360# Research Triangle Inst., Durham, N.C.
COMPREHENSIVE STUDY OF SPECIFIED AIR POLLUTION SOURCES TO ASSESS THE ECONOMIC IMPACT OF AIR QUALITY STANDARDS. VOLUME 2: ASBESTOS, BERYLLIUM MERCURY Final Report
Richard E. Paddock, Franklin A. Ayer, Alex B. Cole, and David A. LeSourd Aug. 1972 134 p refs
(Contract EPA-68-02-0088)
(PB-222858/3; RTI-FR-41U-649-Vol-2; APTD-1548) Avail: NTIS HC $4.50 CSCL 13B

Estimates are made of the costs of controls to reduce the emissions of asbestos fibers, beryllium, and mercury from primary production and selected secondary sources within the Nation. Production processes and control technology are examined. Controls are selected to meet assumed or proposed emission standards and costs are estimated. In addition, an extended analysis is made where appropriate, to determine the economic impact of control costs on each industrial source or group of industrial sources studied. The effects on prices are also estimated. Under the assumed implementation plan, the estimated costs are those that will be incurred during the period of Fiscal Year 1970 through Fiscal Year 1977. Author (GRA)

N74-15361# National Climatic Center, Asheville, N.C.
NORTH PACIFIC TROPICAL CYCLONE STRIKE PROBABILITIES. VOLUME 1: 24 HOUR MOVEMENT
Harold L. Crutcher and Lee R. Hoxit Sep. 1973 102 p refs
Sponsored in part by the Navy
(AD-768308) Avail: NTIS CSCL 04/2

Probabilities relating to the future movement of North Pacific tropical cyclones are presented. The probabilities are based on observational data of successive 12-hour positions of the centers of these storms. The data are stratified into five seasons (June-July, August, September, October, November-May). For the Western North Pacific, the period from November-May was sub-divided into three additional seasons (November, December-January, February-May). Geographical areas are defined by five-degree latitude-longitude squares. The probabilities are computed assuming the initial storm position or origin is always at the center of the square and the target areas are always circular areas with radii of one, two and three degrees latitude which are also located at the center of the squares. These probabilities indicate the chance of the storm center being within the target areas at the end of specified time intervals. Two sets of probabilities are presented for each square: one set for the case when the origin is at the center of the master square, and a second set for the case where the target areas are centered on this square. Values for time intervals of 24 hours, are presented. (Modified author abstract) GRA

N74-15362# National Climatic Center, Asheville, N.C.
NORTH PACIFIC TROPICAL CYCLONE STRIKE PROBABILITIES. VOLUME 2: 48 HOUR MOVEMENT
Harold L. Crutcher and Lee R. Hoxit Sep. 1973 142 p refs
Sponsored in part by the Navy
(AD-768309) Avail: NTIS CSCL 04/2

Values for time intervals of 48 hours are presented. For complete abstract, see N74-15361. GRA

N74-15363# National Climatic Center, Asheville, N.C.
NORTH PACIFIC TROPICAL CYCLONE STRIKE PROBABILITIES. VOLUME 3: 72 HOUR MOVEMENT

Harold L. Crutcher and Lee R. Hoxit Sep. 1973 167 p refs Sponsored in part by Navy
(AD-768310) Avail: NTIS CSCL 04/2

Values for time intervals of 72 hours are presented. For complete abstract, see N74-15361. GRA

N74-15364# Environmental Protection Agency, Washington, D.C. Office of Research and Monitoring.
A SURVEY OF EMISSIONS AND CONTROLS FOR HAZARDOUS AND OTHER POLLUTANTS
A. J. Goldberg Feb. 1973 185 p refs
(PB-223568/7GA; EPA-R4-73-021) Avail: NTIS HC $11.25 CSCL 13B

A preliminary analysis was undertaken to prepare a control technology development plan for air pollution problems facing industry. A literature search was completed (with 144 references) to estimate toxicity levels of 18 pollutants, and the magnitude of emissions from industrial emitter types or classes of emitting processes. A review of control methods organized by pollutants as well as industry, offensive trades (animal processing), food industry (brewery and cannery), chemical industry (paint and rubber), metal industry (foundry and metal coating), other (paper textile, cement, etc.) is included. Minimum controls were often reported where sites were remote to populated areas. Emission hazard data is presented in 14 tables and appendices. Flow charts indicate emission allocations in major areas of processing. Identification and emission points are shown for principal emitting processes. The survey recommends that new R and D should focus on control of non-ferrous emitters, heat and energy generating sources, open mining milling and materials handling as well as several lesser industrial sources, particularly those emitting large amounts of fine particulate material, (less than 2 micron diameter particles). (Modified Author Abstract) GRA

N74-15365# Bureau of Mines, Bartlesville, Okla.
CHARACTERISTICS AND PHOTOCHEMICAL REACTIVITY OF EMISSIONS Final Report
B. Dimitriades, B. H. Eccleston, G. P. Strum, and C. J. Raible Dec. 1972 97 p refs
(Contract EPA-IAG-0138(D))
(PB-223647/9GA; EPA-R2-73-276) Avail: NTIS HC $3.75 CSCL 13B

The report describes three separate projects which relate to the study of the characteristics of automobile exhaust emissions. Part 1 studied the association of automotive fuel composition with exhaust reactivity. This involved experimental tests with different automotive engines and with gasolines of varied composition. Fuel composition was determined by gas chromatography. Exhaust reactivity was both estimated from detailed composition data and determined directly using a smog chamber. Part 2 studied procedures for the determination of any toxic gaseous products resulting from thermochemical reactions of fuel additives in the combustion process. The exhaust analyses included determination of: hydrocarbon, oxygenates, and the additive and its direct combustion products. Part 3 studied the following problems: development of an odorant dilution and presentation system suitable for use with isolated exhaust components and synthetic odorants, establishing methods for demonstrating the reactivity and stability of diesel exhaust odorants, and isolation and collection of unstable components. GRA

N74-15366# Environmental Technical Applications Center (Air Force), Washington, D.C.
THE OCHELTREE TORNADO: A CASE STUDY
William E. Finley, Charles A. Perry, and Billy W. Brown Mar. 1973 35 p refs
(AD-768391; USAFETAC-TN-73-2) Avail: NTIS CSCL 04/2

A classic example of the midwestern United States tornado occurred near Richards-Gebaur AFB, Missouri, on 1 May 1972 (GMT date) as an associated feature of a steady-state severe thunderstorm. This case study of that storm describes synoptic and mesoscale aspects of the situation using meteorological charts and diagrams and presents radar scope photographs from the Air Force Air Weather Service AN/FPS-77 Storm Detection Radar at Richards-Gebaur AFB, near Kansas City, Missouri. Included in the photographs are several highly unusual range height indicator (RHI) sections through the parent thunderstorm and tornado tube. A partial survey of damage caused by the tornado is included. Some suggestions to non-centralized weather forecasters for coping with an imminent tornadic thunderstorm are presented in the final section of the Technical Note. Author (GRA)

N74-15367# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
THERMAL AND CHEMICAL FOG DISSIPATION: RESULTS OF FIELD EXPERIMENTS AT VANDENBERG AFB, CALIFORNIA DURING JULY 1972 Environmental Research Papers
Bruce A. Kunkel, Bernard A. Silverman, and Alan I. Weinstein 8 Aug. 1973 51 p refs
(AF Proj. 7605)
(AD-768671; AFCRL-TR-73-0502; AFCRL-ERP-454) Avail: NTIS CSCL 04/2

Results of thermal and chemical fog dispersal tests, conducted by AFCRL during July 1972, are presented and discussed. Forty-three tests were conducted in fog, thirty-three of which were suitable for analysis. Ninety-six additional heat tests were conducted in clear air. Two wide-area urea seeding tests were also performed. An instrumented 200-ft tower, a lidar, and a ground network of visibility sensors and droplet sampler were used to monitor the effects of the tests on the foggy environment. The seeding tests were unsuccessful. Improper execution of the wide-area seeding pattern due to a lack of knowledge of the winds at the seeding location was responsible for the failure of the seeding tests. (Modified author abstract) GRA

N74-15368# Air Force Ballistic Missile Div., Patrick AFB, Fla.
HERMITE INTERPOLATION ALGORITHM FOR CONSTRUCTING REASONABLE ANALYTIC CURVES THROUGH DISCRETE DATA POINTS Air Force Surveys in Geophysics.
Paul Tsipouras 6 Jul. 1973 33 p refs
(AF Proj. 8624)
(AD-768669; AFCRL-AFSIG-272; AFCRL-TR-73-0400) Avail: NTIS CSCL 04/2

Research was conducted using winds and temperatures measured on a 1500-ft tower at a few irregularly spaced levels. The research methodology required the construction of reasonable analytic curves of wind and temperature vs height. The curves were to be capable of integration and differentiation and were to be generated and plotted by computer without human intervention. Reasonable was subjectively defined as the curve that an individual would most probably draw by hand through the same data points. Of the several techniques tried, only an algorithm consisting of Hermite interpolation between every two successive points with artificial construction of required derivatives generated reasonable curves. Derivatives are artificially constructed by a subroutine which duplicates the constraints that an individual subconsciously employs when drawing a curve through discrete data points. The report discusses the techniques investigated, graphically demonstrates the advantages and reasonableness of this algorithm, and describes it in detail. This algorithm should be applicable for fitting a continuous curve to discrete data of any sort. Author (GRA)

N74-15369# Army Foreign Science and Technology Center, Charlottesville, Va.
MICROSTRUCTURE OF FOG IN KIEV
L. Z. Prokh 8 Aug. 1973 12 p refs Transl. into ENGLISH from the Monograph "Issledovaniya Protsessov Oblako-Osadkoobrazovaniya" Leningrad, 1968 p 136-143
(AD-768703; FSTC-HT-23-1230-72) Avail: NTIS CSCL 04/2

Results are presented of frequent measurements of Kiev fog drop sizes. Measurements were performed with the aid of a slit trap during free precipitation of the fog drops upon horizontal surfaces. GRA

N74-15370# Weather Science, Inc., Norman, Okla.
STUDIES OF THE RAIN PARAMETERS OF RANDOMLY SEEDED WARM AND COLD CUMULI Final Report, 11 May 1970 - 1 Jul. 1973
Joe L. Sutherland and D. Ray Booker 1 Jul. 1973 40 p refs
(Contract F19628-70-C-0228; AF Proj. 7605)
(AD-768970; WR302; AFCRL-TR-73-0515) Avail: NTIS CSCL 04/2

Two hygroscopic seeding experiments on warm cumuli off the Florida coast and in Oklahoma have yielded the following results. The maritime Florida clouds are modified by encapsulated urea seeding in that the initial surge of large raindrops at the beginning of the non-seeded showers is displaced toward the middle of the life of the seeded showers. Also the slope of the raindrop spectra of the seeded Florida clouds is less steep, implying more large drops, and fewer small drops. Even though the raindrop spectra are significantly different, the difference is not large enough to cause a significant difference in the radar reflectivity-rainfall rate relationship. The continental warm cumuli in Oklahoma were not apparently affected by the hygroscopic seeding. However, the seeding amount was appreciably smaller. Calibration testing of the RR40 Raindrop Spectrometer has resulted in an empirical calibration equation that is considerably different from the original calibration equation that was derived from impulse theory. Author (GRA)

N74-15371# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PECULIARITIES OF THE VERTICAL STRUCTURE OF METEOROLOGICAL ELEMENTS IN VARIOUS LATITUDINAL ZONES
L. S. Grandin, R. Mutalov, and L. V. Rukhovets 12 Sep. 1973 15 p refs Transl. into ENGLISH from Glavnaya Geofizicheskaya Observ. (Leningrad), no. 286, 1972 p 55-62
(FTD Proj. T74-01-20)
(AD-768456; FTD-HT-23-777-73) Avail: NTIS CSCL 04/2

The statistical characteristics of the structure for meteorological fields were studied using orthogonal functions to show the vertical interrelationship of the tropics to extratropical regions. The evolution in various latitudinal zones for vertical profiles of geopotential, temperature, and wind are discussed. It is concluded that in the tropical zone, greater resolution and details are required for the observation of vertical systems than is required for extratropical latitudes. F.O.S.

N74-15372# Scripps Institution of Oceanography, La Jolla, Calif.
BIRTH OF HURRICANE AGNES: TRIGGERED BY THE TRANSEQUATORIAL MOVEMENT OF A MESOSCALE SYSTEM INTO A FAVORABLE LARGE-SCALE ENVIRONMENT
Jerome Namias 8 Nov. 1972 5 p refs Repr. from Monthly Weather Rev., v. 101, no. 2, Feb. 1973 p 177-179 Revised
(Contract N00014-66-C-0241; NR Proj. 083-004)
(AD-768975) Avail: NTIS CSCL 04/2

It is the purpose of this note to suggest that the development of the devastating storm Agnes in the second 10 days of June 1972 may have resulted from a combination of events involving an antecedent massive cold air outbreak into the Tropics and, perhaps crucially, the migration of a nucleating cloud cluster of intense convective cells from the Southern Hemisphere Tropics into the Northern Hemisphere. GRA

N74-15373# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 14801 LANCE, MISSILE NO. 2192, ROUND NO. 201 APT (18 OCTOBER 1973) Meteorological Data Report
Oct. 1973 35 p
(DA Proj. 1T6-65702-D-127)
(AD-768838; DR-796) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 14801 Lance, Missile Number 2192, Round Number 201 APT, are presented in tabular form. Author (GRA)

N74-15374# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 14801 LANCE, MISSILE NO. 2204, ROUND NO. 202 APT (18 OCTOBER 1973) Meteorological Data Report
Oct. 1973 37 p
(DA Proj. 1T6-65702-D-127)
(AD-768837; DR-797) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 14801 Lance, Missile Number 2204, Round Number 202 APT, are presented in tabular form. Author (GRA)

N74-15375# Weather Wing (3rd), Offutt AFB, Nebr.
THERMAL PARAMETERS AS PREDICTORS OF PRECIPITATION TYPE FOR GRAND FORKS AFB, NORTH DAKOTA
Russell W. Reed 1 Oct. 1973 22 p
(AD-768717; Rept-3WW-TN-73-4) Avail: NTIS CSCL 04/2

Eight individual thermal parameters and five sets of two parameters from Bismarck, ND, radiosonde data tapes are correlated with the type of precipitation that occurred at Grand Forks AFB, ND, within three hours of radiosonde time. Thermal parameters tested are 1000-850 mb, 1000-700 mb, 1000-500 mb, and 850-700 mb thickness, and surface, 950 mb, 850 mb, and 700 mb temperature. The period of record is May 1959 to August 1964. Author (GRA)

N74-15376# National Climatic Center, Asheville, N.C.
NORTH INDIAN TROPICAL CYCLONE VECTOR MEAN CHARTS
Harold L. Crutcher and Murray L. Nicodemus Oct. 1973 59 p refs Sponsored by Naval Weather Serv. Command
(AD-768733) Avail: NTIS CSCL 04/2

The paper presents resultant directions and distances for tropical cyclone movements in the North Indian Ocean, Bay of Bengal, and Arabian Sea. Charts present the movements for separate five-degree latitude-longitude areas, for five seasons and for six time intervals. In addition, the charts provide sufficient information to allow the user to construct 0.90 probability ellipses. Author (GRA)

N74-15377# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
LANCE, 14801, MISSILE NOS. 2207/2190, ROUND NOS. 197 APT/198 APT (4 OCTOBER 1973) Meteorological Data Report
Oct. 1973 41 p
(DA Proj. 1T6-65702-D-127)
(AD-768836; DR-792) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 14801 Lance, Missile Numbers 2207/2190, Round Numbers 197 APT/198 APT, are presented in tabular form. Author (GRA)

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N74-15378*# Stanford Univ., Calif. Guidance and Control Lab.
MULTI-INPUT, MULTI-OUTPUT REGULATOR DESIGN FOR CONSTANT DISTURBANCES AND NON-ZERO SET POINTS WITH APPLICATION TO AUTOMATIC LANDING IN A CROSSWIND
William E. Holley and Arthur E. Bryson, Jr. Aug. 1973 61 p refs
(Grant NGL-05-020-007)
(NASA-CR-136618; SUDAAR-465) Avail: NTIS HC$5.25 CSCL 09C

Undesirable steady offsets result when a stationary, linear regulator using state feedback is subjected to constant disturbances and/or non-zero setspoints. To eliminate these offsets, the disturbances and non-zero setpoints can be fed forward to the control. Only when the number of outputs is less than or equal to the number of control inputs can the outputs be maintained at arbitrary non-zero setpoints. The state and the disturbance may be estimated using a constant gain Kalman filter or by modeling the constant disturbances as exponentially correlated processes with long correlation times. Author

N74-15379# Lincoln Lab., Mass. Inst. of Tech., Lexington.
EMPIRICAL ASSESSMENT OF ATCRBS Final Report
A. G. Cameron and D. H. Pruslin 31 Oct. 1973 227 p refs
(Contracts DOT-FA72WAI-242; F19628-73-C-0002)
(ATC-16; FAA-RD-73-139) Avail: NTIS HC $13.50

The operational performance of the FAA ATCRBS system, as determined from data extracted from the ARTS III digital processing system is discussed. Quantitative performance data,

as well as discussion of the problem area and possible techniques and procedures for its solution, are provided in the areas of weak/broken targets, synchronous garble, interference, erroneous decoding, improper defruiter operation, and insufficient angular resolution. A discussion of improvements that can alleviate some of the deficiences of today's secondary radar (ATCRBS) system is included. Author

N74-15380# Texas Instruments, Inc., Austin.
FAILURE MODES, EFFECTS AND CRITICALITY ANALYSIS (FMECA) OF CATEGORY III INSTRUMENT LANDING SYSTEM WITH TRAVELING: WAVE LOCALIZER ANTENNA Final Report, Jan. - Oct. 1973
Cliff White Oct. 1973 207 p refs
(Contract DOT-FA71WA-2635)
(U1-840912-100; FAA-RD-73-111) Avail: NTIS HC $12.50

A Failure Modes, Effects and Criticality Analysis (FMECA) is used to optimize system performance by identification of all potentially hazardous failure modes affecting either personal safety of operational mission success. This in-depth systematic approach of such an analysis provides quantitative assurance of the system's reliability and integrity. The previous FMECA performed on the FAA Mark III ILS is updated in this analysis to determine the impact on localizer and system reliability of the additional equipment required by the substitution of the traveling wave antenna array for the wide aperature parabolic antenna. All relevant hidden equipment failure modes are identified within the analysis and based upon allowable probabilities of occurrence, their respective preventive maintenance frequencies are specified. Author

N74-15381# Raytheon Co., Wayland, Mass.
MICROWAVE LANDING SYSTEM (MLS) DEVELOPMENT PLAN AS PROPOSED BY RAYTHEON DURING THE TECHNIQUE ANALYSIS AND CONTRACT DEFINITION PHASE OF THE NATIONAL MLS DEVELOPMENT PROGRAM. VOLUME 1: EXECUTIVE SUMMARY
27 Sep. 1972 40 p ref
(Contract DOT-FA72WA-2803)
(FAA-RD-73-150-1) Avail: NTIS HC $4.00

The design, development, and operation of a microwave landing system are presented. The technical features of the system are described to show the: (1) method of time reference measurement, (2) the scanning beam antenna using electronically-switched feed elements, and (3) the course deviation function. A multipath control technique is described which provides low angle microwave vertical guidance at angles close to the terrain. Diagrams of typical installations of the system are provided. Author

N74-15382# Raytheon Co., Wayland, Mass.
MICROWAVE LANDING SYSTEM (MLS) DEVELOPMENT PLAN AS PROPOSED BY RAYTHEON DURING THE TECHNIQUE ANALYSIS AND CONTACT DEFINITION PHASE OF THE NATIONAL MLS DEVELOPMENT PROGRAM. VOLUME 3: 1.1.1 PERFORMANCE VALIDATION
27 Sep. 1972 379 p refs
(Contract DOT-FA72WA-2803)
(FAA-RD-73-150-3) Avail: NTIS HC $21.00

The multipath and propagation problems of a microwave landing system are discussed. The specific sources of multipath transmission are identified and their effects on the system are analyzed. The influences of refraction, polarization, and rain attenuation are investigated. Proposed solutions are made for: (1) obstacle multipath, (2) ground reflection, (3) blockage, and (4) diffraction. Author

N74-15383# Raytheon Co., Wayland, Mass.
MICROWAVE LANDING SYSTEM (MLS) DEVELOPMENT PLAN AS PROPOSED BY RAYTHEON DURING THE TECHNICAL ANALYSIS AND CONTRACT DEFINITION PHASE OF THE NATIONAL MLS DEVELOPMENT PROGRAM, VOLUME 3A
27 Sep. 1972 363 p refs
(Contract DOT-FA72WA-2803)
(FAA-RD-73-150-3A) Avail: NTIS HC $20.25

The parameters and processing methods that are critical to designing a precision distance measuring equipment system for use with a microwave landing system are discussed. The overall system accuracy, search times, and performance under high density environments are analyzed. Emphasis is placed on: (1) results of system capacity and interference analysis, (2) multipath summary, (3) DME power requirements and low angle coverage, and (4) DME dynamic range. Author

N74-15384# Raytheon Co., Wayland, Mass.
MICROWAVE LANDING SYSTEM (MLS) DEVELOPMENT PLAN AS PROPOSED BY RAYTHEON DURING THE TECHNIQUE ANALYSIS AND CONTRACT DEFINITION PHASE OF THE NATIONAL MLS DEVELOPMENT PROGRAM. VOLUME 4: SYSTEM CONSIDERATIONS 1.1.2 THROUGH 1.1.5
27 Sep. 1972 161 p refs
(Contract DOT-FA72WA-2803)
(FAA-RD-73-150-4) Avail: NTIS HC $10.25

The studies and analyses to support the development of a microwave landing system are presented. The subjects considered are: (1) the economic model and life cycle costs, (2) time reference angular measurement against coding on the beam, (3) integrity enchancement by dual angle mode encoding, (4) beam forming network, (5) electronic scan compared with mechanical scan, and (6) system configuration and deployment tradeoffs. The compatibility of the microwave system with airport installations and with aircraft types, missions, and aerodynamics is analyzed. Author

N74-15385# Raytheon Co., Wayland, Mass.
MICROWAVE LANDING SYSTEM (MLS) DEVELOPMENT PLAN AS PROPOSED BY RAYTHEON DURING THE TECHNIQUE ANALYSIS AND CONTRACT DEFINITION PHASE OF THE NATIONAL MLS DEVELOPMENT PROGRAM. VOLUME 5: POST TA/CD PLANS, MANAGEMENT PERFORMANCE
27 Sep. 1972 310 p refs
(Contract DOT-FA72WA-2803)
(FAA-RD-73-150-5) Avail: NTIS HC $17.50

The proposed methods for conducting a feasibility demonstration, prototype development, and limited production of a microwave landing system are discussed. The plans consist of: (1) test and evaluation, (2) analytical verification, (3) hardware design and fabrication, (4) prototype hardware design and fabrication, and (5) reliability and maintainability. Author

N74-15386# Raytheon Co., Wayland, Mass.
MICROWAVE LANDING SYSTEM (MLS) DEVELOPMENT PLAN AS PROPOSED BY RAYTHEON DURING THE TECHNIQUE ANALYSIS AND CONTRACT DEFINITION PHASE OF THE NATIONAL MLS DEVELOPMENT PROGRAM. VOLUME 6: SUPPORTING STUDIES, APPENDICES D THROUGH N
27 Sep. 1972 591 p refs
(Contract DOT-FA72WA-2803)
(FAA-RD-73-150-6-App-D-N) Avail: NTIS HC $31.75

Various studies which were conducted during the planning and development of a microwave landing system are presented. The subjects considered include the following: (1) obstacle multipath effects, (2) rough ground effects, (3) refraction, (4) convex runways, and (5) aircraft blockage. A summary of computer simulation results is developed. Circuit development practices and diagrams of subsystem circuits are provided. Author

N74-15387# Stanford Univ., Calif. Guidance and Control Lab.
ADVANCE RESEARCH IN GUIDANCE, CONTROL, AND INSTRUMENTATION Final Report
Daniel B. DeBra, Arthur E. Bryson, Jr., and J. David Powell
Sep. 1973 64 p refs
(Contract F33615-72-C-1297; AF Proj. 5102)
(AD-768560; AFAL-TR-73-288) Avail: NTIS CSCL 17/7

The report deals with two subject areas: (a) Navigational System Optimal Integration, and (b) Stabilization for Precision Pointing and Tracking. Under the first subject area a theoretical investigation was conducted on the possibility of using all of the navigational aids (DME, VOR, TACAN, inertial systems, Air data systems, etc) aboard aircraft to improve the navigational position accuracy of the vehicle. This investigation resulted in the development of a Kalman filter for using these inputs and

an estimation of the computer size needed to perform the task of giving a more accurate position location of the aircraft. Data was obtained from NASA on DME and VOR test data and used in the program and Kalman filter developed under this work effort. The results obtained showed that for the data used the position of the aircraft can indeed be more accurately determined. Under the second subject area a design procedure and design modification for the particular instrument investigated. The primary effort was concentrated on the pointing control loop and the tracking control loop. (Modified author abstract) GRA

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N74-15388*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPATIBILITY OF REFRACTORY MATERIALS FOR NUCLEAR REACTOR POISON CONTROL SYSTEMS
John H. Sinclair Washington Jan. 1974 38 p refs
(NASA-TM-X-2963; E-7581) Avail: NTIS HC $3.00 CSCL 18I

Metal-clad poison rods have been considered for the control system of an advanced space power reactor concept studied at the NASA Lewis Research Center. Such control rods may be required to operate at temperatures of about 1400 C. Selected poison materials (including boron carbide and the diborides of zirconium, hafnium, and tantalum) were subjected to 1000-hour screening tests in contact with candidate refractory metal cladding materials (including tungsten and alloys of tantalum, niobium, and molybdenum) to assess the compatibility of these materials combinations at the temperatures of interest. Zirconium and hafnium diborides were compatible with refractory metals at 1400 C, but boron carbide and tantalum diboride reacted with the refractory metals at this temperature. Zirconium diboride also showed promise as a reaction barrier between boron carbide and tungsten. Author

N74-15389*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ASSESSMENT OF LIGHTWEIGHT MOBILE NUCLEAR POWER SYSTEMS
John L. Anderson and Frank E. Rom 1973 45 p refs Presented at Winter Meeting of the Am. Nucl. Soc., San Francisco, 11-15 Nov. 1973
(NASA-TM-X-71482; E-7806) Avail: NTIS HC $4.25 CSCL 21F

A review was made of lightweight mobile nuclear power systems (LMNPS). Data cover technical feasibility studies of LMNPS and airborne vehicles, mission studies, and non-technical conditions that are required to develop and use LMNPS. Author

N74-15390# Westinghouse Astronuclear Lab., Pittsburgh, Pa. Astronuclear Lab.
TECHNICAL SUMMARY REPORT OF NERVA PROGRAM. VOLUME 6: TECHNOLOGY DISSEMINATION FROM THE NUCLEAR ROCKET PROGRAM; NEW COMPANIES, CAPABILITIES, PROCESSES, AND PRODUCTS
Dec. 1972 35 p refs
(Contract SNSO-1)
(TNR-230-Vol-6) Avail: NTIS HC $3.75

A limited effort was initiated to trace some of the technology transfer and upgrading of industrial capability resulting from the impetus of the nuclear rocket program. The specific intent was to identify industrial products, processes, capabilities and new contractor organizations resulting from the stimulus of the program. The preliminary findings of the limited investigation are discussed. The avenues of search are described and results are listed under several categories. The preliminary search effort was devoted to seeking those component vendors associated with new products, new manufacturing techniques and quality control changes, to finding development and testing laboratories with increased capability, to finding who in the NERVA project team knew about the changes, and to obtaining a brief description of what transpired at the time. NSA

N74-15391# New South Wales Univ., Kensington (Australia). School of Nuclear Engineering.
ENERGY SITUATION AND NUCLEAR POWER
Z. J. Holy 1973 29 p refs
(NP-19838) Avail: AEC Depository Libraries $3.50

A survey of the characteristics and potential applications of nuclear reactors for electricity and process heat production is presented, against a background of increasing global energy demand, fossil and nuclear fuel reserves, and environmental problems of power production. The large scale adoption of nuclear power using breeder reactor systems appears inevitable in the long term, but complex and rapidly changing interaction between local and global factors makes projections for any specific country increasingly difficult. Author (NSA)

N74-15392# Atomic Energy of Canada Ltd., Chalk River (Ontario). Nuclear Labs.
INTERPRETATION OF CORROSION-PRODUCT PHASES OBSERVED IN U3Si AFTER IN-REACTOR DEFECT TESTS
M. A. Feraday May 1973 27 p refs
(AECL-4452) Avail: AEC Depository Libraries HC $3.50; Atomic Energy of Can., Ltd., Chalk River HC $1.00

The corrosion-product phases observed in one low-burnup and three high-burnup U3Si specimens after in-reactor defect tests were identified by comparison with those observed in out-of-reactor tests. Five of the six corrosion product phases observed in the out-of-reator tests were present in fuel examined after the in-reactor defect tests, i.e., alpha USi2, beta USi2, USi3, U3Si(H) and UOx. The depth of penetration of hydrogen into U3Si in high-burnup fuel appeared to be greater than in unirradiated and very low-burnup U3Si. This deeper penetration is thought to be due to microcracks in the U3Si. Since the appearance and distribution of the phases in the four specimens examined were fairly consistent, identification of phases in future defect tests should be facilitated. Author (NSA)

N74-15393# Westinghouse Electric Corp., Large, Pa. Astronuclear Lab.
NERVA PROGRAM. VOLUME 5: ABSTRACTS OF SIGNIFICANT NERVA DOCUMENTATION
Sep. 1972 178 p refs
(Contract NSO-1)
(TNR-230-Vol-5) Avail: NTIS

Summaries of significant NERVA documentation are presented in technical abstract form for external use. The intent is to provide both document identification and quantitative technical summaries so that, for many users, these abstracts themselves may provide sufficient information for their uses. The format of the abstracts was established so as to be suitable for technology utilization dissemination and to be readily adaptable for dissemination in other ways. NSA

N74-15394# Gulf General Atomic, San Diego, Calif.
EQUIPMENT AND TECHNIQUES FOR THE UTILIZATION OF NEUTRON RADIOGRAPHY WITH THERMIONIC FUEL ELEMENTS
S. E. Schwarzer and G. O. Fitzpatrick 26 Mar. 1973 31 p refs
(Contract AT(04-3)-840)
(GULF-GA-A-12521) Avail: NTIS HC $4.00

With the aid of neutron radiography, the periodic nondestructive examination of highly radioactive thermionic fuel elements and fuel-clad tests has been possible. These examinations have allowed the observation of fuel and structural changes as a function of time and have greatly facilitated diagnostics during testing. The data acquired often allows design changes to be made more than one year earlier than would normally be possible using information obtained from the hot cell examination after testing has been terminated. Author (NSA)

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics, 20 Meteorology; and 29 Space Radiation.

N74-15395* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

METHOD AND APPARATUS FOR NONDESTRUCTIVE TESTING Patent

James M. Hoop, inventor (to NASA) Issued 1 Jan. 1974 6 p Filed 20 Apr. 1972 Supersedes N72-25627 (10 - 16, p 2183)

(NASA-Case-MFS-21233-1; US-Patent-3,782,177; US-Patent-Appl-SN-246056; US-Patent-Class-73-71.5U; US-Patent-Class-73-67.5R; US-Patent-Class-324-40) Avail: US Patent Office CSCL 20N

High voltage is applied to an arc gap adjacent to a test specimen to develop a succession of high frequency arc discharges. Those high frequency arc discharges generate pulses of ultrasonic energy within the test specimen without requiring the arc discharges to contact that test specimen and without requiring a coupling medium. Those pulses can be used for detection of flaws and measurements of certain properties and stresses within the test specimen. Official Gazette of the U.S. Patent Office

N74-15396 Cincinnati Univ., Ohio.

MOESSBAUER STUDIES OF MAGNETISM IN DILUTE ALLOYS OF TANTALUM AND TUNGSTEN IN IRON Ph.D. Thesis

David Langhammer 1973 108 p

Avail: Univ. Microfilms Order No. 73-24844

The Mossbauer technique was used to study the magnetic interaction Delta at W-182 sites in dilute Ta(x)Fe(1-x) and (W-162).03 Fe.97 alloys using the 100.1 keV gamma ray resonance. The experiment utilized sources of Ta-182 in neutron irradiated arc melted Ta(x)Fe(1-x) alloys with absorbers of natural W foils, and a natural linewidth source of Ta-182(Ta) with an absorber of W-182(Fe). Results indicate that neutron radiation damage effects are not responsible for the decrease in magnetic interaction values. Dissert. Abstr.

N74-15397 Dartmouth Coll., Hanover, N.H.

A STUDY OF IRRADIANCE SCINTILLATION EFFECTS OF AN OPTICAL WAVE PROPAGATING THROUGH A TURBULENT ATMOSPHERE Ph.D. Thesis

Ting-i Wang 1973 132 p

Avail: Univ. Microfilms Order No. 73-27571

Amplitude or irradiance scintillations of an optical wave propagating in a clear turbulent atmosphere are studied. The probability distribution of the irradiance is specified by a log-normal distribution or a Rice-Nakagami distribution. A simple set of equations is derived to describe the variance and covariance functions of log-amplitude fluctuations and also the log-irradiance fluctuations in order to show whether the variance of the log-irradiance fluctuations saturates and even decreases with increasing path length and turbulence. Results show that irradiance fluctuations cannot be strictly log-normal in the saturation region and that this assumption is not useful in calculating the log-irradiance variances and covariances. Dissert. Abstr.

N74-15398# Lockheed Missiles and Space Co., Palo Alto, Calif.

ROLE OF PARAMETRIC INSTABILITY AND INHOMOGENEITY OF THE LOCAL FIELD IN AMPLIFICATION OF A FERROMAGNETIC ECHO

Ia. Ia. Asadullin and U. Kh. Kopvillem [1973] 8 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (USSR), v. 18, no. 4, 1973 p 565-572

Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A quantum mechanical theory of amplified ferromagnetic echo (AFE) is reported. The nature and procedures for calculating AFE are included. The theory is based on nonlinear interactions between perturbations originating from ferromagnet excitation by short electromagnetic pulses. E.H.W.

N74-15399*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

SUITABILITY OF THE RARE-EARTH COMPOUNDS $Dy_2Ti_2O_7$ AND $Gd_3Al_5O_{12}$ FOR LOW TEMPERATURE (4K-20K) MAGNETIC REFRIGERATION CYCLE

D. J. Flood 1973 8 p refs Presented at 19th Ann. Conf. on Magnetism, Boston, 13-16 Nov. 1973; sponsored by Am. Inst. of Phys. and by Magnetic Soc. of IEEE

(NASA-TM-X-71493; E-7847) Avail: NTIS HC $3.00 CSCL 20M

Measurements were made of the magnetic entropy and magnetization of powered samples of the compounds $Dy_2Ti_2O_7$ and $Gd_3Al_5O_{12}$. The magnetization was measured for temperatures at and below 4.2 K, in applied fields ranging to 7.0 tesla. Isothermal changes in magnetic entropy were measured for temperatures from 1.2 to 20 K, in applied fields up to 10 tesla. The results of the measurements are consistent with a doublet ground state for $Dy_2Ti_2O_7$, and an eight-fold degenerate ground state for $Gd_3Al_5O_{12}$. Absolute values of magnetic entropy have been obtained at the lower temperatures, permitting the isotherms to be properly located in the S-H plane with the use of adiabatic magnetization data. The iso-field lines in the S-T plane were determined. The results indicate that $Dy_2Ti_2O_7$ can absorb a maximum of 71 + or - 4 joules/kg of heat at 4.2 K, while $Gd_3Al_5O_{12}$ can absorb 233 + or - joules/kg at the same temperature. The large difference between the two is most likely a result of crystal field interactions in the dysoprosium compound. Both materials can be cycled adiabatically between 4.2 and 20 K. Author

N74-15400# Southampton Univ. (England). Inst. of Sound and Vibration Research.

THE CHARACTERISATION OF WAVE PROPAGATION MECHANISMS USING TRANSIENT EXCITATION: CONTINUOUS SYSTEMS AND THE EFFECTS OF DISPERSION

P. J. Holmes Jun. 1973 111 p refs Sponsored by Min. of Defence

(ISVR-TR-62) Avail: NTIS HC $7.75

A preliminary study of the wave propagation approach in the characterization of structural/acoustic systems was conducted. Continuous and dispersive systems are considered, with flexural wave propagation of particular interest. The measurement of time delays and attenuation factors by cross correlation offers a useful approach to system characterization, in addition to the measurement of frequency response. The dispersion encountered in flexural wave propagation increased the difficulty in interpretation of correlation data. A second transient excitation function was developed which has single frequency content but will permit direct measurement of group velocities. Model and practical experimental work was carried out in order to investigate the theoretical analyses and to demonstrate the use of the two excitation functions. Tests on a built-up structure indicate the value of the wave propagation approach in practical tests in addition to displaying some of its limitations. Author (ESRO)

N74-15401# Ferranti-Packard Electric, Ltd., Toronto (Ontario).

FABRICATION OF A LIGHTWEIGHT SUPERCONDUCTING MHD MAGNET Final Report, Sep. 1970 - May 1973

David Gluck and David L. Atherton May 1973 78 p refs

(Contract F33615-69-C-1212; AF Proj. 3145)

(AD-768222; L515; AFAPL-TR-73-63) Avail: NTIS CSCL 10/2

The report contains the details of fabricating a lightweight superconducting magnet suitable for a portable magnetohydrodynamic (MHD) project. Problems in winding of the pancake coils, bending of the coil ends to a saddle form and bonding of the insulation were overcome by controlled dimensioning and variable fixturing. Preimpregnated E glass filament strands are used for the former and hoops. Construction techniques are illustrated. Epoxy fibreglass cloth end plates and glass filament ties are used to restrain the end repulsive forces. Basic differences of the actual magnet fabricated and the final design conception (reference design 69) are included together with additional stress and heat calculations for the dewar and magnet system.

Author (GRA)

N74-15402# Stanford Univ., Calif. Dept. of Computer Science.

THE HETRODYNE FILTER AS A TOOL FOR ANALYSIS OF TRANSIENT WAVEFORMS
James Anderson Moorer Jul. 1973 29 p refs
(ARPA Order 457)
(AD-767334; SU-STAN-CS-73-379; AIM-208) Avail: NTIS CSCL 20/1

A method of analysis of transient waveforms is discussed. Its properties and limitations are presented in the context of musical tones. The method is shown to be useful when the risetimes of the partials of the tone are not too short. An extension to inharmonic partials and polyphonic musical sound is discussed. Author (GRA)

N74-15403# Stanford Univ., Calif. Dept. of Computer Science.
THE OPTIMUM COMB METHOD OF PITCH PERIOD ANALYSIS OF CONTINUOUS DIGITIZED SPEECH
James Anderson Moorer Jul. 1973 24 p refs
(ARPA Order 457)
(AD-767333; SU-STAN-CS-73-378; AIM-207) Avail: NTIS CSCL 20/1

A new method of tracking the fundamental frequency of voiced speech is described. The method is shown to be of similar accuracy as the Cepstrum technique. Since the method involves only additions, no multiplication, it is shown to be faster than the SIFT algorithm. Author (GRA)

N74-15404# Ballistic Research Labs., Aberdeen Proving Ground, Md.
INTENSITY INTERFEROMETRY IN THE SPATIAL DOMAIN (2)
Paul H. Deitz and E. Paul Carlson Sep. 1973 29 p refs
Repr. from J. Opt. Soc. Am. Presented at Spring Meeting of the Opt. Soc. of Am., Denver, 13-16 Mar. 1973
(DA Proj. 1M5-62603-A-286)
(AD-768783; BRL-1668) Avail: NTIS CSCL 20/6

Intensity interferometry, as developed by Hanbury Brown and Twiss for stellar observation, has shown relative insensitivity to atmospheric scintillation. However, with classical sources, the limitations placed on this technique by quantum noise and detector efficiency are severe. This situation is vastly improved when laser illumination is employed. Generalizing a form of the mutual coherence function, the authors derive the far-zone behavior of the mutual intensity function for an intermediate time average. This result is used to reconstruct the irradiance distribution of a spatially rough source. The far-field intensity distribution is recorded spatially for one time-resolution unit of the detector. The resulting spatial signal is autocorrelated and related to the intensity distribution over the source. Thus, without averaging in the time domain, a spatial Fourier-transform relation is derived between the far-field intensity correlation and the source irradiance, similar to the results of Hanbury Brown and Twiss. (Modified author abstract) GRA

N74-15405# National Aerospace Lab., Tokyo (Japan).
DISTORTIONS OF SONIC BOOM PRESSURE SIGNATURE BY SOUND AND TURBULENCE INTERACTION
Nagamasa Kono 1973 28 p refs In JAPANESE; ENGLISH summary
(NAL-TR-334) Avail: NTIS HC $3.50

In order to estimate the effect of large eddies in atmospheric turbulence near the earth surface upon a sonic boom pressure signature, an experimental and theoretical investigation concerning the scattering of sound by a nonisotropic turbulence has been performed. An ultrasonic sound beam with frequencies in the range 15-300 kHz is transmitted and allowed to traverse the wake of a circular cylinder. The amplitude modulated sound signal due to turbulence interaction is separated into mean and fluctuating components, and the sound attenuation and the scattering energy spectrum are obtained over the ratio of the incident sound wave length to the scale of eddies from unity to about a hundred. This result was compared with Lighthill's general theory of sound and turbulence interaction applied to three types of a large eddy model, and distortions of a normal N-wave are calculated employing these models. Author

N74-15406# Bendix Research Labs., Southfield, Mich.
COHERENT OPTICAL IMAGE-PLANE CORRELATOR STUDY Final Report, Nov. 1971 - Mar. 1973
Daniel C. Kowalski Aug. 1973 67 p refs
(Contract F30602-72-C-0108)
(AD-769003; BRL-6514; RADC-TR-73-240) Avail: NTIS CSCL 20/6

A coherent optical image-plane correlator has been evaluated for use in automating stereo-perception in stereophotogrammetric instruments. A previously developed breadboard correlator was modified to incorporate real-time control functions as required for automatic stereo-perception. With stereo-photographs of a laboratory stereomodel, the correlator, successfully demonstrated its profiling capability by automatically clearing x and y parallax and correcting x-scale due to slope. With typical stereo aerial photography, inconsistent plotting performance was experienced. This result is attributed to the inadequacy of the simple control loops of the experimental correlator to cope with the spatially variant properties of aerial photography. While this problem could be overcome, it is recommended that subsequent effort be directed toward a different type of optical system which would make maximum use of the power of optical computing techniques while minimizing real-time adaptive control requirements. The approach considered is that of an epipolar coherent optical correlator which would perform parallel multichannel computation of one-dimensional correlation functions. Author (GRA)

N74-15407# American Univ., Washington, D.C. Dept. of Physics.
STUDIES OF MAGNETIC PROPERTIES IN RARE EARTH ALLOYS AT CRYOGENIC TEMPERATURES Interim Technical Report, Dec. 1969 - Dec. 1972
Romeo Segnan and Daniel M. Sweger 31 Dec. 1972 98 p refs
(Contract DAAK02-70-C-0102; DA Proj. 1T6-62705-A-012)
(AD-768870) Avail: NTIS CSCL 07/4

The research contributes to an understanding of the interactions responsible for the magnetic behavior of rare earth alloys on the atomic level as an essential step in correlating the basic interactions with the bulk properties of such alloys. Nuclear hyperfine magnetic (NHM) and quadrupolar (NHQ) interaction studies were performed using the 161Dy Mossbauer resonance in the magnetic system Dy(x)Gd(1-x). The NHM and NHQ interactions were measured as a function of concentration and temperature up to the Neel (Curie) points. The data for internal field strengths are compared to existing molecular field and spin-wave theories. (Modified author abstract) GRA

N74-15408# Naval Air Development Center, Warminster, Pa. Aero-Electronic Technology Dept.
TRANSMISSIVE SIMILARITY AND SCALE MODELS IN A LIGHT ABSORBING, RANDOMLY SCATTERING MEDIUM
Cyrus Beck Oct. 1973 14 p
(AD-768743; NADC-73135-20) Avail: NTIS CSCL 20/6

The concept of transmissive similarity is introduced and explained. Some basic laws governing similarity in a light absorbing, randomly shallow angle scattering, macroscopically homogeneous medium are derived in terms of the absorption coefficient and the dispersion (not scattering) coefficient. Absorptive and dispersive similarity are subsumed under transmissive similarity. Applying the similarity laws developed, the procedure is presented for determining the optical properties of the medium required to obtain the desired scale model. Three examples illustrate the method. The transmissive partial differential equation is given in dimensional and dimensionless form. Author (GRA)

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N74-15409# Maryland Univ., College Park. Center for Theoretical Physics.
ROTATIONAL ANALYTICITY OF THE S MATRIX

Alex J. Dragt and George F. Sterman Nov. 1973 38 p refs
(Grant NSF GP-32418)
(TR-74-050) Avail: NTIS HC $4.00

It is shown that both scattering and production amplitudes are analytic functions on the group SU(2). This analyticity is then used to give a simple derivation of high energy bounds for scattering amplitudes of particles with spin. It is also used to display the origin of kinematic singularities in both scattering and production amplitudes. Author

N74-15410# Maryland Univ., College Park. Center for Theoretical Physics.
LEADING LOGARITHMIC BEHAVIOR OF ELECTROMAGNETIC FORM FACTORS IN BOUND STATE MODELS
George F. Sterman Dec. 1973 13 p refs
(Grant NSF GP-32418)
(TR-74-053) Avail: NTIS HC $3.00

A detailed calculation of the asymptotic behavior of electromagnetic form factors of the Bethe-Salpeter ladder model of the S wave fermion scalar bound state for large space like momentum transfer has been carried out. In contrast to earlier results, it is found that the magnetic form factor behaves as (q squared) to the minus two power 1 n to the fifth power (minus q squared) when the fermion constituent is charged. Implications of this high power of the logarithm are briefly discussed. Author

N74-15411# Maryland Univ., College Park. Center for Theoretical Physics.
GAUGE THEORIES OF STRONG INTERACTION, SPECTRAL FUNCTION SUM RULES AND CHIRAL SYMMETRY BREAKING
Rabindra N. Mohapatra Nov 1973 32 p refs
(Grant NSF GP-20709)
(TR-74-042) Avail: NTIS HC $3.75

Using the explicit form of the strong interaction Hamiltonian provided by a certain class of gauge theories, and the technique of Bjorken-Johnson-Low expansion, we derive sum rules relating the vector, axial vector, scalar and pseudoscalar spectral functions and the chiral symmetry breaking parameters. Consistency of the sum rules in the pseudoscalar (PS) meson sector demands that, there should be a heavy nonet of PS-mesons. It is shown that, the nature of chiral symmetry breaking depends on the character of these heavy mesons. The two modes of symmetry breaking resulting from this are studied. Using the assumption of pole dominance for the spectral functions, we evaluate the chiral symmetry breaking parameters in one case. We also evaluate decay widths of rho, omega and phi mesons to lepton pairs. Author

N74-15412*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RADIATIVE TRANSITIONS INVOLVING THE (2p2)(3 Pe) METASTABLE AUTODETACHING OF H(-)
V. L. Jacobs (NAS-NRC), A. K. Bhatia, and A. Temkin Jan. 1974 18 p refs Submitted for publication
(NASA-TM-X-70570; X-602-74-13) Avail: NTIS HC $3.00 CSCL 20H

The absorption coefficient for the free-bound transition H (ls) + e(-)+ h omega yields H(-)(2 sq p,(3)P(e)) is calculated (together with the differential emission rate for the inverse process) using ls - 2s - 2p close coupling continuum wave functions and a Hylleraas bound state wave function. A maximum in the absorption and emission spectra is found to occur at a photon wavelength of 1219.5 A, which is 2 A closer to the Lyman alpha line than predicted by the calculations of Drake, and is in closer agreement with the stellar absorption feature identified by Heap and Stecher. The free-bound absorption process appears to be a significant source of continuous ultraviolet opacity. Author

N74-15413# Lockheed Missiles and Space Co., Palo Alto, Calif.
INSTRUMENT TO RECORD THE FLUXES AND ENERGY SPECTRUM OF ELECTRONS WITH ENERGIES ABOVE 10 TO THE 8TH POWER eV IN COSMIC RAYS
N. L. Grigorov, L. F. Kalinkin, G. I. Pugacheva, and I. A. Savenko [1973] 6 p refs Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow), v. 13, no. 4, 1973 p 580-584
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Illinois 60616

The instrument consists of scintillation and Cerenkov counters forming two directional telescopes. The aperture of each of the telescopes is covered periodically by a 2.7 rad. units thick lead filter. The possibility of extracting electrons from the proton and nuclei background is based on the difference in the probability of formation of electron-photon showers in the filter material by the electrons and the heavier particles. The instrument was calibrated by electron and proton beams from accelerators, as well as by mu-mesons and cosmic ray electrons at sea level. Author

N74-15414# Cornell Univ., Ithaca, N.Y. Lab. of Atomic and Solid State Physics.
THE SHORT RANGE INTERACTION BETWEEN HYDROGEN MOLECULES
A. K. McMahan, H. Beck, and J. A. Krumhansl Jan. 1974 50 p refs
Avail: NTIS HC $4.50

Recent calculations of the ground state energy of a system of four hydrogen atoms are reviewed from the point of view of discerning the short range interaction potential between two hydrogen molecules. Consistency amongst the results of these calculations suggests that the potential for intermolecular separations in the region 1-2.5A can now be specified to about ten percent with considerable confidence. Analytic fits to spherical averages of these results are presented. For calculations of properties of high density solid molecular hydrogen, the bare pair potential may thus be regarded as well determined. The role of multicenter terms can then be examined; as for example, recent reported work seems to indicate that pairwise additivity is not altogether valid in practice. Author

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N74-15415 British Library Lending Div., Boston Spa (England).
AXISYMMETRICAL CLOSED FLOWS GENERATED BY A TRAVELLING FIELD AT LOW MAGNETIC REYNOLDS NUMBERS
R. V. Birikh, V. A. Briskman, and V. K. Rudakov Nov. 1973 16 p refs Transl. into ENGLISH from Uch. Zap. Permsk. Gos. Univ. (Perm), v. 216, no. 2, 1970 p 241-253
(BLL-RTS-8524) Avail: British Library Lending Div., Boston Spa, Engl.: £1.50 or 5 BLL photocopy coupons

Two exact approximation solutions for the equations of magnetohydrodynamics are obtained which describe axisymmetrical closed motions in an infinite, circular, vertical cylinder. The first solution gives the distribution of the flow velocities generated by a rotating magnetic field. The second solution describes the axial motion of the fluid generated by the magnetic field travelling along the generator of the cylinder. Author

N74-15416 Princeton Univ., N.J.
SPECTROSCOPIC STUDIES OF THE EXHAUST PLUME OF A QUASI-STEADY MPD ACCELERATOR Ph.D. Thesis
Adam Peter Bruckner 1972 176 p
Avail: Univ. Microfilms Order No. 73-23192

Spectroscopic and photographic investigations reveal a complex azimuthal species structure in the exhaust plume of a quasi-steady argon MPD accelerator. Over a wide range of operating conditions the injected argon remains collimated in discrete jets which are azimuthally in line with the six propellant injector orifices. The regions between these argon jets, including the central core of the exhaust flow, are occupied by impurities such as carbon, hydrogen, and oxygen ablated from the Plexiglas back plate of the arch chamber. The features of this plume structure are found to be dependent on the arc current and mass flow rate. Time resolved spectroscopic velocity measurements indicate argon ion jet velocities of 16,500 m/sec, which considerably exceeds the alfven critical speed of argon. It

is found that nearly half the observed velocity is attained in an acceleration region well dowstream of the region of significant electromagnetic interaction. Dissert. Abstr.

N74-15417 Washington Univ., Seattle.
EXPERIMENTS ON THE INTERACTION OF A CO2 LASER BEAM WITH A MAGNETICALLY CONFINED PLASMA COLUMN Ph.D. Thesis
Noel Alfred Amherd 1973 114 p
Avail: Univ. Microfilms Order No. 73-27636

The phenomena of laser beam trapping and absorption by a deuterium plasma was demonstrated by use of a theta pinch device axially irradiated by a CO2 TEA laser. The density range was 10 to the 16th power to 10 to the 17th power/cu cm and the non-irradiated plasma temperature range upwards from 1.3eV. Time and space resolved measurements of the radiation transmitted through the plasma showed periods of favorable refraction during the implosion phase of the plasma dynamics, i.e., when the plasma had the form of a hollow cylinder. As the density increased near the axis then absorption became important. A dramatic illustration of beam trapping was obtained by use of laser's ability to burn marks on black Polaroid film. Placing the film at the transmission end of the pinch device showed enhanced burning on the plasma axis when a favorable plasma density profile existed during the irradiation. Temperature measurements of the irradiated plasma showed a temperature increase at those times when the beam was trapped.
Dissert. Abstr.

N74-15418# Joint Publications Research Service, Arlington, Va.
NANOSECOND ELECTRON ACCELERATOR
G. A. Mesyats and S. P Bugayev 28 Dec. 1973 13 p refs Transl. into ENGLISH from Priroda (Moscow), no. 6, 1972 p 78-84
(JPRS-60880) Avail: NTIS HC $3.00

Data are reported on a nanosecond electron accelerator, the explosive emission of electrons, the generation of nanosecond impulses, the obtaining and focusing of relativistic electron and the application of high power electron beams. Author

N74-15419# Sandia Labs., Albuquerque, N.Mex.
VORTEX-STABILIZED PLASMA ARCS AS HIGH-POWER RADIATION SOURCES
G. R. Hadley Sep. 1973 24 p refs
(Contract AT(29-1)-789)
(SLA-73-581) Avail: NTIS HC $4.00

The behavior of a vortex-stabilized plasma arc was studied to determine its performance in the megawatt power range. This is accomplished by the use of a simple core model which seems to contain all the essential physical processes that make up arc behavior. Predictions made on the basis of the core model are consistent with experimental observation at lower power and should be reliable well above 10 Mw provided that blackbody conditions are avoided. Author (NSA)

N74-15420# Oak Ridge National Lab., Tenn.
THOMSON SCATTERING MEASUREMENTS IN ORMAK
M. Maurakami, W. R. Wing, J. S. Culver, and P. H. Edmonds Sep. 1973 32 p refs
(Contract W-7405-eng-26)
(ORNL-TM-4354) Avail: NTIS HC $3.75

Measurements were made of electron temperature in the Tokamak type discharge device, ORMAK, using light Thomson scattered by the plasma electrons. The radial electron temperature profiles observed in stable discharges are broad while a tendency toward sharpened profiles appears when the discharges become unstable at low safety factor. Plasma energy/poloidal magnetic field energy is observed to ranges between 0.8 and to 0.3. The overall picture of the ORMAK plasma appears similar to that of a conventional Tokamak, and no significant deleterious effects have been observed despite extension of the Tokamak configuration to low aspect ratio, producing a nearly collisionless plasma. Author (NSA)

N74-15421# California Univ., Los Angeles.
OPTIMAL CONFINEMENT OF COLLISIONLESS PLASMAS BY LOCALIZED TIME VARYING ELECTRIC FIELDS
P. K. C. Wang Jul. 1973 39 p refs
(Grant AF-AFOSR-2303-72; AF Proj. 9752)
(AD-768597; UCLA-ENG-7353; AFOSR-73-1633TR) Avail: NTIS CSCL 20/9

The problem of optimal confinement of collisionless plasmas by means of external amplitude-limited time-varying electric fields localized to an outer layer enclosing the confinement region (a specified closed bounded spatial domain) is considered. To confine the plasma, the external electric field (control) establishes a finite potential barrier for the escaping particles. The field direction for confinement depends on the sign of the electrical charge of the escaping particles inside the layer. The paper begins with a formal development of the plasma equations. Then, the existence and uniqueness of solutions of these equations are established. This is followed by the formulation of the optimal confinement problem along with a discussion of the existence of an optimal electric field (control). By introducing additional assumptions to simplify the problem, suboptimal feedback controls are obtained. Finally, the effectiveness of the derived feedback controls is determined numerically using a computer-simulated plasma. Author (GRA)

N74-15422# Massachusetts Inst. of Tech., Cambridge. Dept. of Aeronautics and Astronautics.
KINETIC THEORY OF UNSTABLE PLASMAS FOR THERMONUCLEAR POWER Final Scientific Report
J. E. McCune May 1973 8 p refs
(Grant AF-AFOSR-1697-69)
(AD-768596; AFOSR-73-1634TR) Avail: NTIS CSCL 20/9

The document contains a brief review of progress made in a study of the interaction of an intense electron beam with a dense plasma. (Modified author abstract) GRA

N74-15423# Science Applications, Inc., La Jolla, Calif.
THEORETICAL STUDY OF NON-LTE PROCESSES IN LASER HEATED PLASMAS Final Report, 15 Jun. - 14 Jun. 1973
Stephen Tamor Oct. 1973 46 p refs
(DNA Proj. NWED-P-001)
(AD-769077; SAI-73-545-LJ; DNA-3175F) Avail: NTIS CSCL 20/9

The development of a code for calculating the non-LTE kinetics of the excitation and ionization of a laser heated plasma, and prediction of the emitted X-ray spectrum is described. This code is intended to be used for exploratory studies in which X-ray conversion efficiencies for various densities, compositions, temperature profiles, etc., are calculated. To carry out such computations rate coefficients for all possible transitions must be available. A simple method of calculating these rates is derived. Since numerous runs involving a wide range of parameter choices is envisaged it is desired that the basic time step in the integration be very large. The resulting problem of stiffness of the rate equations and methods of overcoming it are discussed. Preliminary results for a neon plasma are presented. Author (GRA)

N74-15424# Technischen Universitaet, Munich (West Germany). Elektrophysikalisches Inst.
AIR PLASMA PROPERTIES AT HIGH TEMPERATURES Final Report
H. Maecker Nov. 1973 48 p refs
(Grant AF-AFOSR-2280-72; AF Proj. 7073)
(AD-768792; ARL-73-0150) Avail: NTIS CSCL 20/9

In order to investigate the properties of air mixtures and related gases cascade arc chambers of 5 mm diam. are fed with the gas desired. Careful measurements of the field strength E and the total radiation U depending on current and gas composition were carried out. An apparatus for spectroscopic temperature measurements with evaluation by computer technique on-line was installed. Temperature measurements were performed. For the special case of hydrogen, viscosity measurements done. In the spectrum of an oxygen arc burning in a quartz tube at low currents the affinity continuum due to attachment of free electrons to neutral oxygen atoms could be found and measured whereby the affinity energy could be determined. (Modified author abstract) GRA

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N74-15425 British Library Lending Div., Boston Spa (England).
OBSERVATION OF THE EFFECT OF TEMPERATURE ON FERROELECTRIC DOMAIN STRUCTURE USING A SCANNING ELECTRON MICROSCOPE
M. K. Antoshin and G. V. Spivak 5 Jul. 1973 8 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Fiz. (Moscow), v. 36, no. 9, 1972 p 1901-1905
(BLL-RRE-Trans-393-(8036.625)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

The possibilities of investigating a number of ferroelectrics (barium titanate, calcium dihydrophosphate, triglycinesulphate) at different temperatures using the scanning electron microscope are discussed. Author

N74-15426 British Library Lending Div., Boston Spa (England).
EPITAXIAL GROWTH OF SOLID SOLUTIONS In SUBx Ga SUB 1-x P FROM THE GASEOUS PHASE
P. I. Shtogrin, V. P. Maslov, B. A. Sakharov, and L. A. Firsanova 13 Sep. 1973 5 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Neorgan Mater. (Moscow), v.8, no. 10, 1972 p 1755-1758
(BLL-Trans-873-(9022.64)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

The crystallization of solid solutions InxGa(1-x)P during epitaxial growth from the gaseous phase are considered by using a method of close positions of the source and of the base (sandwich method) in a hydrogen atmosphere using high-purity anhydrous HC1 as a reagent and carrier. The morphology, and growth rate dependence of various orientations on the composition of the source are discussed. F.O.S.

N74-15427 British Library Lending Div., Boston Spa (England).
THE EFFECT OF ANNEALING ON RESISTIVITY VARIATIONS IN SILICON SINGLE CRYSTALS
F. Dannhauser, J. Krausse, and K. Mayer 13 Sep. 1973 6 p refs Transl. into ENGLISH from Solid-State Electron. (London), v. 15, no. 12, 1972 p 1383-1385 (German language document)
(BLL-Trans-869-(9022.64)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

Striations in semiconductor silicon were detected after extreme annealing by chemical etching as well as by electrical measurements of the resistivity profile. The result was explained in relation to recent values for the diffusion of phosphorus in silicon. Author

N74-15428 Lehigh Univ., Bethlehem, Pa.
IMPURITY REDISTRIBUTION DURING SILICON EPITAXIAL GROWTH AND SEMICONDUCTOR DEVICE PROCESSING Ph.D. Thesis
Paul H. Langer 1973 139 p
Avail: Univ. Microfilms Order No. 73-23808

A model was developed that can account for both front and back autodoping effects during epitaxial growth as well as impurity redistribution during further high temperature processing. The model incorporates three dopant fluxes: (1) the flux from the solid into the gas phase at the rear of the wafer, (2) the flux from the solid to the front surface of the wafer, and (3) the flux from the bulk gas phase into the boundary layer near the front surface of the wafer in which transport of dopant occurs by diffusion only. The redistribution of impurities both within the solid semiconductor and in the gas phase are investigated from a theoretical viewpoint. A computer program is presented that can handle the simultaneous redistribution of five dopant elements, during processing steps such as epitaxial growth, oxidation, and ion implantation. Implications of differences between this approach and previous work is discussed. Calculated results are presented to illustrate the variety of problems that may be solved using this mathematical approach. Dissert. Abstr.

N74-15429 Pennsylvania Univ., Philadelphia.
ADMITTANCE STUDIES OF SURFACE QUANTIZATION IN (100) ORIENTED Si MOSFETS Ph.D. Thesis
Alexander Michael Voshchenkov 1973 172 p
Avail: Univ. Microfilms Order No. 73-24233

The behavior of the minority charge carriers of the inversion layer under quantized conditions was observed by small signal magnetoadmittance (Y) and magnetoconductance (G) experiments on p-type (100) Si MOSFET structures. The MOSFET capacitor necessary for Y studies was realized by shorting the source and drain to the substrate to form one terminal while the gate was the other one. The dependence of Y on a number of variables was investigated. Comparative studies of small signal surface conductance and admittance were useful in establishing the advantages and limitations of each technique. It was observed that Y becomes frequency independent at frequencies below 500 Hz. Structure associated with minima in the density of states is excitation electric field dependent and disappears when the MOSFET is overdriven. At low fields, this structure is field independent. Both the line-shape and fine structure observed in Y at threshold is attributed to a bound state band overlapping the conduction band. Dissert. Abstr.

N74-15430 Wisconsin Univ., Madison.
SUPERCONDUCTIVE ENERGY STORAGE INDUCTORS FOR POWER SYSTEMS Ph.D. Thesis
Narendra Mohan 1973 111 p
Avail: Univ. Microfilms Order No. 73-20266

Large toroidal magnets with superconductive windings could serve to perform a system function equivalent to hydro pumped storage. In sizes greater than 1,000 MW-hrs, preliminary economic studies have shown some promise. It is demonstrated by means of computer simulation that the power flow through the energy storage inductor can be reversed within a few cycles using a conventional Graetz converter bridge with an appropriate control. A system with interconnected stream-electric areas is simulated on the hybrid computer. The system performance, with and without the energy storage device, is studied in response to the random load changes. The deviation of area frequency from the normal and the change in tie line power flow are used as error signals for controlling the energy storage inductors. Dissert. Abstr.

N74-15431 Paris Univ. (France). Lab. de Physique des Solides.
INFRARED STUDY OF ALKALINE-EARTH OXIDE MONOCRYSTALS Final Report [ETUDE DANS L'INFRA-ROUGE DE MONOCRISTAUX D'OXYDES ALCALINO-TERREUX COMPTE-RENDU DE FIN DE CONTRAT]
Yves Farge, Marco Fontana, Pierre Lagarde, Morton Nerenberg, and Mariette Regis Nov. 1972 81 p refs Partly in ENGLISH and partly in FRENCH
(Contract DGRST-70-02-211)
Avail: Issuing Activity

The circular magnetic dichroism of the MgO/Ni(2+) system was measured in the near infrared range. Results confirmed that both spectral bands observed correspond to magnetic bipolar transition towards two states, one of degenerative state due to a Jahn-Teller dynamic effect. The infrared spectrum of Ca(OH)2 was studied around 3600/cm, and a theoretical model for the high-energy sidebands of the OH(-) stretching mode is given. The adjustable parameters were determined through experimental low energy phonon frequencies. The experimental and theoretical results on infrared absorption of monocrystalline samples and the shape of dispersion curves of phonons are given. The absorption infrared spectrum of biatomic monocrystals was studied and applied to the MgO. ESRO

N74-15432+ Paris Univ. (France). Lab. de Physique des Solides.
PHOTOVOLTAIC EFFECT IN LEAD SELENIDE P-N JUNCTIONS
I. Chambouleyron, J. M. Besson, and M. Balkanski 1972 30 p refs
Avail: NTIS HC $3.50

A phenomenological explanation of the various mechanisms involved in the photovolatic effect of lead selenide is proposed relating them to the known properties of the substrate material and diode profile. The photoresponse of diodes was studied as a function of temperature between 10 and 300 K with base material concentration ranging from 5 to 6 to the 18th power cu cm charge carriers at 77 K. Different mechanisms appear to be important in the effect. It was shown that the shape of the spectra depends on the diffusion techniques and junction chemical profiles as well as on the carrier concentration in the illuminated portion of the material. Radiative recombination must be taken into account to explain the shape and variation of the spectra. A comparison with the Burstein shift measured by optical transmission on crystalline slabs gives quantitative support for the proposed mechanism. Author (ESRO)

N74-15433+ Radiotechniques S. A., Caen (France). Div. Industrielle et Technique.
GALLIUM ARSENIDE CRYSTALLIZATION IN SOLUTION Final Report [CRISTALLISATION EN SOLUTION Ga As COMPTE RENDU DE FIN DE CONTRAT]
J. M. LeDuc and J. P. Biet Nov. 1971 95 p refs In FRENCH
(Contract DCRST-70-7-2254)
Avail: NTIS HC $6.75

The Czochralski method was applied to the solution crystallization and growth of gallium arsenide epitaxial layers of 5 micron depth. The experimental design and operational principles are presented. The gallium arsenide crystallization conditions and the influence of some parameters, such as rotational speed, temperature gradient substrate orientation, and surface preparation, are outlined. The optimization of the gradient freeze' Bridgman method applied to the gallium arsenide growth is discussed with emphasis on technological improvements and the decrease of the number of inclusions and dislocation defects. Quality of crystals was controlled using the cathodoluminescence technique and the electron scanning microscope. ESRO

N74-15434*# Clark Univ., Worcester, Mass. Dept. of Physics.
EXPERIMENTAL INVESTIGATION OF THE CRITICAL MAGNETIC FIELDS OF TRANSITION METAL SUPERCONDUCTORS Final Report, 1 Jun. 1972 - 31 May 1973
Joseph P. McEvoy 31 May 1973 52 p refs
(Contract NAS8-28900)
(NASA-CR-120127) Avail: NTIS HC $4.75 CSCL 20L

The isothermal magnetic transitions of a type 2 superconductor have been studied by AC susceptibility techniques as a function of the amplitude and frequency of the exciting field. The field variation of the complex susceptibility was used to determine the critical fields. The research was planned to clarify the determination (both experimentally and theoretically) of the maximum field at which the superconductive phase spontaneously nucleates in the bulk and on the surface of the metal. Author

N74-15435*# Notre Dame Univ., Ind. Dept. of Electrical Engineering.
ELECTRODE MATERIALS FOR CHARGE COUPLED DEVICES
W. T. Jr. Gajda Oct. 1973 31 p refs
(Contract NAS1-12468)
(NASA-CR-132348) Avail: NTIS HC $3.75 CSCL 20L

The use of polycrystalline silicon in charged coupled semiconductor devices is discussed. In particular, the electrical and optical properties of the material are characterized. E.H.W.

N74-15436*# Kanner (Leo) Associates, Redwood City, Calif.
THE EFFECT OF SURFACE CONDITIONS ON REFLECTION AND SCINTILLATION SPECTRA OF CdS CRYSTALS
M. S. Brodin, A. V. Kritsky, E. N. Myasnikov, M. I. Strashnikova, and L. A. Shlyakhova Washington NASA Jan. 1974 14 p Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 18, May 1973 p 824-829
(Contract NASw-2481)
(NASA-TT-F-15242) Avail: NTIS HC $3.00 CSCL 20B

A form analysis of low temperature reflection spectra of CdS crystals of different qualities was conducted. It was found that in using a neutral etchant on spallation fragments or natural surfaces of high quality crystals, the shape of the exciton line may undergo cardinal changes. At the same time, a scintillation line is observed above the primary peak; this attests to formation of a corresponding surface energy state. Author

N74-15437# California Univ., Livermore. Lawrence Livermore Lab.
CRYOGENIC ENGINEERING AND FUSION POWER
C. E. Taylor 6 Aug. 1973 18 p refs Presented at Cryogenic Eng. Conf., Atlanta, 8-10 Aug. 1973 Sponsored by AEC
(UCRL-74935; Conf-730805-9) Avail: NTIS HC $3.00

Several superconducting coil systems for Tokamaks, magnetic mirrors, and theta pinch fusion reactors are described. Engineering problems associated with each of these concepts are discussed. NSA

N74-15438# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France). Dept. d'Etudes et de Recherches en Technologie Spatiale.
ROLE OF FRIEDEL OSCILLATIONS IN THE METAL INTERFACIAL ENERGY [ROLE DES OSCILLATIONS DE FRIEDEL DANS L'ENERGIE D'INTERFACE DES METAUX]
D. Rouhani and R. Schuttler Jul 1973 29 p refs In FRENCH
(ONERA-DERTS-NT-02-73) Avail: NTIS HC $3.50

The influence of Friedel oscillations on the interfacial energy between two metals or one metal and the vacuum was evaluated. Results obtained using a mathematical model are in agreement with experimental results for low electron density metals. However, it was found that for high electron density metals, the ionic potential is important and jellium model was not applicable. Two mechanisms of Friedel oscillation contribution to the total surface energy are proposed. The first is due to induced positive charge excess at the surface and leads to electrical neutrality of the system; the second is due to self-oscillation energy. ESRO

N74-15439# National Physical Lab., Teddington (England). Div. of Quantum Metrology.
A TEST OF THE MATERIAL INDEPENDENCE OF THE AC JOSEPHSON EFFECT
J. C. Gallop Aug. 1973 14 p refs
(NPL-QU-25) Avail: NTIS HC $3.00

An experiment is proposed which will investigate any possible dependence of the superconducting flux quantum on material. The time variation of the circulating supercurrent in a ring containing two Josephson junctions is discussed, taking into account the continuity of both the electric field and the superconducting pair phase around the ring. A precise method for detecting a circulating current in such a structure is outlined and preliminary results of the experiment are given which yield a null result at the level of precision of 2 in 1 billion. Author (ESRO)

N74-15440# Rockwell International Corp., Anaheim, Calif.
FUNDAMENTAL STUDIES OF SEMICONDUCTOR HETEROEPITAXY, PART 1 Final Report, Jun. 1970 - Jun. 1973
Ralph P. Ruth, A. James Hughes, Joseph L. Kenty, Harold M. Manasevit, and Arthur C. Thorsen Aug. 1973 272 p refs
(Contract DAAH01-70-C-1311; ARPA Order 1585)
(AD-767287; C71-86/501-Pt-1) Avail: NTIS CSCL 09/1

Contents: Theory of epitaxy and heteroepitaxial interfaces; Deposition studies and film preparation; Analysis and purification of chemical vapor deposition (CVD) reactants; Chemistry and reaction kinetics of CVD processes; Preparation and characterization of substrates; Al2O3 characterization by carrier injection and transport measurements. GRA

N74-15441# New Mexico Univ., Albuquerque. Bureau of Engineering Research.
ENERGY STATES IN RANDOM MEDIA
Peter C. C. Chang and W. J. Byatt Aug. 1973 84 p refs
(Contract N00014-68-A-0158)
(AD-767732; EE-210(73)ONR-005) Avail: NTIS CSCL 20/12

The report is concerned with energy levels and the density of states in random crystal. By developing a non-linear differential equation for the phase process in random crystals, it is shown how to calculate the density of states in one-dimensional random arrays. The method used has the virtues of simplicity and, where comparison with previous numerical results can be made,

accuracy, with minimal computing time. Various analytical results are found with the phase process method and these are equivalent with results found by other workers. In the three-dimensional case, it is shown how to use the phase process to help construct the Green's function and, from it, the density of states. No applications are given. By expanding in plane waves, a secular determinant is found for the determination of the energy eigenvalues in a random crystal. (Modified author abstract) GRA

N74-15442# Missouri Univ., Rolla. Graduate Center for Materials Research.
MAGNETIC STRUCTURE DETERMINATION OF RARE EARTH-COBALT-IRON SYSTEMS, RFe(x)CO(5-x) BY NEUTRON DIFFRACTION Annual Technical Report, 15 Mar. 1972 - 31 Jul. 1973
William J. James and Remy Lemaire Aug. 1973 43 p refs
(Contract F33615-71-C-1332; AF Proj. 7367)
(AD-768989; AFML-TR-73-219; ATR-2) Avail: NTIS CSCL 20/12

Magnetic, X-ray and neutron diffraction studies were made to determine the magnetic and structural effects produced by substitution of Fe for Co in intermetallic compounds of the CaCu5-type structure with space group P6mmm. Compounds of Th(Co(1-x)Fe(x))5 and Y(x)La(1-x)(Co(y)Fe(1-y))4.5-5.0 were prepared by various induction methods and then annealed. The samples were characterized by X-ray powder analysis and metallographically. The easy axis of magnetization was determined by X-ray diffraction of powdered specimens oriented in a magnetic field. In all cases the axis is found to be vector c. (Modified author abstract) GRA

N74-15443# Princeton Univ., N.J. Solid State and Materials Lab.
OXIDE CHARGE TRAPPING INDUCED BY ION IMPLANTATION IN SiO2
Eli Harari and Barrie S. H. Royce 24 Sep. 1973 10 p refs
(Contract N00014-67-A-0157-0026)
(AD-767054; PSSL-240973) Avail: NTIS CSCL 09/1

Experimental measurements directed at understanding oxide modifications induced by Na- and Al- ion implantation are described. Both implanted species created high dark conductivity in unannealed specimens. This had a temperature dependence independent of ion type suggesting that the conductivity is related to displacement damage. Internal photoemission studies showed that Na-implantation had produced a barrier lowering at both interfaces and also permitted sub-threshold photoemission starting with photons of about 1 eV. Thermal annealing returned the oxide to its insulating state and removed the sub-threshold photoemission. Photodepopulation measurements indicated that the oxide still contained electron traps not present in the unimplanted samples. Author (GRA)

N74-15444# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
CATHODOLUMINESCENCE OF ION IMPLANTED ZnS M.S. Thesis
Sidney L. Johnson, Jr. Jun. 1973 85 p refs
(AD-767877; GEP/PH/73-11) Avail: NTIS CSCL 20/12

Sodium ion implanted zinc sulfide crystals were studied by observing the luminescence produced by incident electrons with energies between 4 and 15 keV. Spectral comparisons were made between 100, 200, and 300 keV sodium implanted, sodium doped, and pure melt grown zinc sulfide crystals. The relative increase in the size of the UV band located at approximately 3450A was attributed to the presence of sodium. A possible energy level model is discussed. Author (GRA)

N74-15445# Air Force Ballistic Missile Div., Patrick AFB, Fla.
A VERTICAL THERMAL-IMAGING FURNANCE FOR SINGLE CRYSTAL GROWTH
William G. Field and John L. Sampson 2 Jul. 1973 39 p refs
(AD-768670; AFCRL-TR-73-0386; AFCRL-IP-192) Avail: NTIS CSCL 20/2

The concepts of thermal-imaging as applied to the growth of single crystals are presented. A brief history of thermal-imaging is covered with special emphasis on the work done at AFCRL. The design and construction of a vertical furnace embodying these principles is covered together with its use for the growth of a number of single crystals. The furnace represents an advance in the techniques of growth of single crystals of many materials with Air Force applications, including laser hosts, substrate materials, and permanent magnet alloys. It makes possible the growth of these materials without contamination from crucibles and in optimum atmospheres. Author (GRA)

N74-15446# Stanford Univ., Calif. Center for Materials Research.
RESEARCH ON AMORPHOUS MATERIALS Final Technical Report, 1 Jun. 1972 - 31 May 1973
W. E. Spicer, A. Bienenstock, and R. H. Bube 31 May 1973 11 p refs
(Grant DA-ARO(D)-31-124-72-G151; ARPA Order 1562)
(AD-768805; SU-CMR-73-10) Avail: NTIS CSCL 20/12

The problems addressed under this contract can most easily be broken down into three groups. The first involves the determination of electronic structure of amorphous materials, e.g., density of states and optical selection rules. Here considerable emphasis was placed on the changes in electronic structure observed in going from the crystalline to amorphous forms of the materials and in comparison of the experimental results with theoretical predictions. The second part of the work emphasized the structural aspect of amorphous materials and the development and refinement of experimental and theoretical tools by which the structure can be determined. The third feature of this project was a study aimed at the problem of photoconductivity in the rather complex chalcogenide alloys. Experimentally, the approach was to study the measurement of dark current, photoconductivity, thermoelectric power and field effect. A theoretical model was developed for photoconductivity in these materials which is consistant with the experimental data. GRA

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N74-15447 Wyoming Univ., Laramie.
LOW ENERGY GAS UTILIZATION IN COMBUSTION GAS TURBINE Ph.D. Thesis
John M. Cegielski, Jr. 1973 335 p
Avail: Univ. Microfilms Order No. 73-25541

Gases having a net heat of combustion less than 150 Btu per standard cubic foot were successfully used to partially fuel a modified 11.2 kilowatt combustion gas turbine generator set. A modification to the combustion gas turbine engine enabled the low energy gases to be substituted for a portion of the compressed air normally supplied to the combustion chamber. Two sets of field tests were conducted. The first test set used the exhaust gas (Sloss gas) from a secondary oil recovery operation. The second set used the stack gas from an experimental oil-shale retort. Twelve stack gas combustion efficiency tests were conducted. An average of 70.3% of the stack gas net heat of combustion which ranged from 28.9 to 51.5 Btu per standard foot was utilized by the combustion gas turbine engine. Thirty-six Sloss gas combustion efficiency tests were conducted. An average of 70.1% of the Sloss gas net heat of combustion which was 147 Btu per standard cubic foot was utilized by the combustion gas turbine engine. Dissert. Abstr.

N74-15448# Oak Ridge National Lab., Tenn.
STORAGE AND TRANSPORTATION OF SYNTHETIC FUELS. A REPORT TO THE SYNTHETIC FUELS PANEL
J. E. Johnson Sep. 1972 20 p refs
(Contract W-7405-eng-26)
(ORNL-TM-4307) Avail: NTIS HC $3.00

A review of the problems associated with the storage and transportation of energy by the major candidate synthetic fuel systems hydrogen and hydrogen-derived fuels, such as ammonia and methanol is presented. Particular emphasis has been placed on the identification of limiting technologies and on areas in

which research and development efforts should be undertaken to contribute solutions to the nation's growing problems of energy resources, transmission and conversion. Author (NSA)

N74-15449# Oak Ridge National Lab., Tenn.
PROSPECTS FOR HYDROGEN AS A FUEL FOR TRANSPORTATION SYSTEMS AND FOR ELECTRICAL POWER GENERATION
W. J. D. Escher Sep. 1973 56 p refs
(Contract W-7405-eng-26)
(ORNL-TM-4305) Avail: NTIS HC $5.00

The potential application of hydrogen, produced from non-fossil domestic sources, is examined for applicability to the transportation and electrical generation sectors. The characteristics of hydrogen as a gas and as a cryogenic liquid are noted; cost trends are presented. Ground, water, and air transportation modes and systems are individually examined with respect to a potential conversion to hydrogen fuel. Electrical generation systems, both conventional and unconventional, are assessed similarly. Hydrogen's potential for transmission and storage of electrical energy is cited. From these findings, a detailed list of recommended study, research and development, and demonstration system topics is given toward implementing an eventual conversion of transportation and the electrical utilities to hydrogen fuel. Author (NSA)

N74-15450# Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.
SURFACTANTS AND THEIR EFFECTS ON FILTER/SEPARATORS
T. H. Jefferson and S. B. Boulware Jun. 1973 33 p refs
(DA Proj. 1G6-62708-D-506)
(AD-768696; USAMERDC-2066) Avail: NTIS CSCL 21/4

Surfactants (surface-active agents) in certain concentrations and combinations are known to have a harmful effect on filter/separators. They affect the basic physicochemical parameters associated with coalescence and the removal of solid particulate from hydrocarbon fuels. The basic parameters affected include cohesion, adhesion, contact angle, surface free energy, fuel velocity, electrostatic charge generation, and differential pressure across the coalescent media. Tests conducted on military filter/separators indicate that JP-4 and JP-5 jet fuel can be decontaminated properly; however, problems exist in the decontamination of water from Motor Gasoline (MoGas) and No. 2 Diesel fuel. Tests conducted to determine the effect of surfactants versus electrostatic charge generation indicate that small amounts of surfactants or combinations of surfactants and free water or solid particulates can convert a nearly inert fuel into a fuel producing high and dangerous levels of static electricity. Author (GRA)

N74-15451# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE STRENGTH OF VISCOELASTIC MATERIALS AS APPLIED TO CHARGES OF SOLID-PROPELLANT ROCKET ENGINES
V. V. Moskvitin 11 Oct. 1973 362 p refs Transl. into ENGLISH of the publ. "Soprotivleniye Vyazko-Uprugikh Materialov Primenitelno k Zaryadam Raketnykh Vigateley na Tverdom Toplive" USSR, 1972 p 1-328
(AD-769045; FTD-MT-24-714-73) Avail: NTIS CSCL 21/9

Contents: Selected information from the mechanics of rigid bodies; Viscoelastic media; Strength conditions long-term strength; Polymerization stresses; The action of internal pressure; Thermal stresses and strains; Dynamic loads; Stresses and strains with overloads and under conditions of long-term storage; Vibrational heat buildup and the simulation of thermal loads; Requirements imposed on viscoelastic materials used in load-bearing structures. GRA

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magneto-hydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N74-15452 British Library Lending Div., Boston Spa (England).
ON THE USE OF INTERNAL COMBUSTION ENGINES IN WORKING PLACES WITH AN EXPLOSION HAZARD
K. H. Gehm 5 Jul. 1973 8 p Transl. into ENGLISH from the publ. "Arbeitschutz", 1956 p 256-257
(BLL-SMRE-Trans-6079-(8313.4)) Avail: British Library Lending Div., Boston Spa, Engl: 1 BLL photocopy coupon

The steady increase in the size of industrial plants using flammable materials and their intensified rationalization entail an increasing use of internal combustion engines. The majority of these plants are locations with an explosion hazard. In such plants, the design of the internal combustion engine must be such as to guarantee that ignition of an ambient explosive mixture is, in practice, impossible. Such an ignition can be caused by a hot surface (e.g. the walls of an exhaust gas duct), by electrical sparks (e.g. switching sparks), by glowing particles (e.g. glowing oil carbon in the exhaust gases), etc. Guide lines for reducing the occurrence of such ignition hazards are considered. Author

N74-15453* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GAS TURBINE EXHAUST NOZZLE Patent
David M. Straight, inventor (to NASA) Issued 25 Dec. 1973 6 p Filed 19 Dec. 1972 Supersedes N73-14792 (11 - 05, p 0590)
(NASA-Case-LEW-11569-1; US-Patent-3,780,827; US-Patent-Appl-SN-316618; US-Patent-Class-181-43) Avail: US Patent Office CSCL 21F

An elongated hollow string is disposed in an exhaust nozzle combustion chamber and communicates with an air source through hollow struts at one end. The other end of the string is bell-mouth shaped and extends over the front portion of a nozzle plug. The bell-mouth may be formed by pivotally mounted flaps or leaves which are used to vary the exhaust throat area and the area between the plug and the leaves. Air from the engine inlet flows into the string and also between the combustion chamber and a housing disposed around the chamber. The air cools the plug and serves as a low velocity inner core of secondary gas to provide noise reduction for the primary exhaust gas while the other air, when it exits from the nozzle, forms an outer low velocity layer to further reduce noise. The structure produces increased thrust in a turbojet or turbofan engine.
Official Gazette of the U.S. Patent Office

N74-15454 Wisconsin Univ., Madison.
THE DIVIDED COMBUSTION CHAMBER CONCEPT AND DESIGN FOR CONTROL OF SI ENGINE EXHAUST AIR POLLUTANT EMISSIONS Ph.D. Thesis
Ibrahim Ahmed El-Messiri 1973 308 p
Avail: Univ. Microfilms Order No. 73-19298

The divided combustion chamber engine was designed specifically for control of SI engine air pollutant emissions through basic modification of the combustion process within the engine. The basis for reduction of pollutant emissions is division of the combustion space into two regions, a primary chamber and a secondary chamber. These two chambers communicate via an orifice. Just prior to ignition the primary chamber contains a homogeneous combutible fuel-air mixture while the secondary chamber contains only air. Following ignition, burned combustion gases expand immediately and with high velocity into the secondary chamber, where rapid mixing with the relatively cool secondary chamber air suppresses further formation of nitric oxide. At the same time, further oxidation of carbon monoxide and unburned hydrocarbons, issuing from the primary chamber, occurs. The engine is operated with an overall fuel-air ratio that is leaner than chemically correct, thus affording control of unburned

hydrocarbon carbon monoxide emissions as well as nitric oxide.
Dissert. Abstr.

N74-15455# National Research Council of Canada, Ottawa (Ontario). Div. of Mechanical Engineering.
INVESTIGATION OF A SMALL HYDROGEN-OXYGEN ROCKET ENGINE
R. Sandri, R. Billingham, and F. Chellingworth Aug. 1973 37 p refs
(NRC-13556; MP-64) Avail: NTIS HC $4.00

An investigation on a small water-cooled, liquid oxygen/liquid hydrogen rocket engine has established the design of an efficient combustion system using a low pressure-drop injector. Five different injector combinations were considered and their combustion efficiencies evaluated. Heat transfer measurements were made and the effects of injector design on heat transfer profiles studied. Preliminary investigations were also made on a regeneratively-cooled combustion chamber, using hydrogen flowing through a simple annular cooling passage. Author

N74-15456# National Aeronautical Lab., Bangalore (India).
INVESTIGATION OF THE DYNAMIC STRENGTH OF BLADING OF HIGH PRESSURE TURBINES IN THE GAS TURBINE UNIT (AT KALUGA TURBINE PLANT)
L. I. Ostrovskii and D. A. Arkadev Jul. 1972 20 p refs Transl. into ENGLISH from Energomashinostr. (USSR), no. 12, 1970 p 34-36
(NAL-TR-119) Avail: NTIS HC $3.00

The vibrational reliability of gas turbine blades was studied by their dynamic spectral frequencies and maximum dynamic stresses as function of working conditions. High temperature strain gage measurements of tangential vibration frequencies were used to determine the strength of blade tail connections and their reliability. G.G.

N74-15457# National Aeronautical Lab., Bangalore (India).
EXPERIMENTAL DETERMINATION OF FREQUENCIES AND MODES OF VIBRATIONS IN TURBINE BLADES
A. P. Yakovlev and G. C. Pisarenko Sep. 1973 14 p ref Transl. into ENGLISH from the publ. "Russeyaniya Energii Pri Kolebaniyakh Uprugikh Sistem" Kiev, Tekh., 1962 p 170-176
(NAL-TR-185) Avail: NTIS HC $3.00

High frequency vibration tests on turbine blades show that blades having a dense spectrum of natural vibrations easily fall into resonance vibrations with high modes of bending, twisting and laminar excitations. G.G.

N74-15458# National Aeronautical Lab., Bangalore (India).
DESIGNING TURBOMACHINE BLADES FOR FORCED VIBRATIONS UNDER VARIOUS EXCITATION CONDITION
U. S. Vorobiev and N. G. Medvedev Sep. 1973 16 p refs Transl. into ENGLISH from Probl. Prochnosti v Mashinostr., Akad. Nauk SSSR, Inst. Mashinoved. (Moscow), v. 4, Nov. 1972 p 15-19
(NAL-TR-186) Avail: NTIS HC $3.00

Blade stresses due to vibrations may attain dangerous values even under nonresonant conditions. The problem of forced vibrations of turbomachine blades is solved by taking into consideration various external forces and the complex geometry of the object. Author

N74-15459*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SOLID MOTOR DIAGNOSTIC INSTRUMENTATION
Y. Nakamura, W. E. Arens, and W. S. Wuest 1 Dec. 1973 83 p refs
(Contract NAS7-100)
(NASA-CR-136561; JPL-TM-33-656) Avail: NTIS HC $6.25 CSCL 21H

A review of typical surveillance and monitoring practices followed during the flight phases of representative solid-propellant upper stages and apogee motors was conducted to evaluate the need for improved flight diagnostic instrumentation on future spacecraft. The capabilities of the flight instrumentation package were limited to the detection of whether or not the solid motor was the cause of failure and to the identification of probable primary failure modes. Conceptual designs of self-contained flight instrumentation packages capable of meeting these reqirements were generated and their performance, typical cost, and unit characteristics determined. Comparisons of a continuous real time and a thresholded hybid design were made on the basis of performance, mass, power, cost, and expected life. The results of this analysis substantiated the feasibility of a self-contained independent flight instrumentation module as well as the existence of performance margins by which to exploit growth option applications. Author

N74-15460*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THRUST PERFORMANCE OF ISOLATED PLUG NOZZLES WITH TWO TYPES OF 40-SPOKE NOISE SUPPRESSOR AT MACH NUMBERS FROM 0 TO 0.45
Douglas E. Harrington and James J. Schloemer Washington Jan. 1974 37 p refs
(NASA-TM-X-2951; E-7541) Avail: NTIS HC $3.00 CSCL 21E

Plug nozzles with two types of 40-spoke noise suppressor were tested at free-stream Mach numbers from 0 to 0.45 and over a range of nozzle pressure ratios from 1.5 to 4.0. In additon, an unsuppressed plug nozzle and a Supersonic Tunnel Association nozzle were also tested to provide baseline levels of thrust performance. The unsuppressed plug nozzle had an efficiency of 98 percent at an assumed takeoff pressure ratio of 3.0 and at Mach 0.36. At the same condition the suppressor nozzles had efficiencies of approximately 83.5 percent. Author

N74-15461*# Pratt and Whitney Aircraft, West Palm Beach, Fla. Research and Development Center.
ADVANCED SPACE ENGINE PRELIMINARY DESIGN Final Report
J. P. B. Cuffe and R. E. Bradie Dec. 1973 410 p refs
(Contract NAS3-16750)
(NASA-CR-121237; PWA-FR-5654) Avail: NTIS HC $22.50 CSCL 21H

A preliminary design was completed for an O2/H2, 89 kN (20,000 lb) thrust staged combustion rocket engine that has a single-bell nozzle with an overall expansion ratio of 400:1. The engine has a best estimate vacuum specific impulse of 4623.8 N-s/kg (471.5 sec) at full thrust and mixture ratio = 6.0. The engine employs gear-driven, low pressure pumps to provide low NPSH capability while individual turbine-driven, high-speed main pumps provide the system pressures required for high-chamber pressure operation. The engine design dry weight for the fixed-nozzle configuration is 206.9 kg (456.3 lb). Engine overall length is 234 cm (92.1 in.). The extendible nozzle version has a stowed length of 141.5 cm (55.7 in.). Critical technology items in the development of the engine were defined. Development program plans and their costs for development, production, operation, and flight support of the ASE were established for minimum cost and minimum time programs. Author

N74-15462*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SERT C PROJECT STUDY
Jan. 1974 338 p
(NASA-TM-X-71508) Avail: NTIS HC $19.00 CSCL 21C

The SERT C (Space Electric Rocket Test - C) project study defines a spacecraft mission that would demonstrate the technology readiness of ion thruster systems for primary propulsion and station keeping applications. As a low cost precursor, SERT C develops the components and systems required for subsequent Solar Electric Propulsion (SEP) applications. The SERT C mission requirements and preliminary spacecraft and subsystem design are described. Author

N74-15463*# Hamilton Standard Div., United Aircraft Corp., Windsor Locks, Conn.
VELOCITY CONTROL PROPULSION SUBSYSTEM OF THE RADIO ASTRONOMY EXPLORER SATELLITE FOR GODDARD SPACE FLIGHT CENTER Final Report
W. Braught, E. K. Moore, and R. L. Steinberg [1973] 317 p
(Contract NAS5-11463)
(NASA-CR-132905; SVHSER-6226) Avail: NTIS HC $18.00 CSCL 21H

The Velocity Control Propulsion Subsystem (VCPS) was designed the propulsion required for trajectory and lunar orbit

corrections of the spacecraft. A GFE clamp assembly physically attaches the VCPS to the spacecraft and the unit is ejected after completing the required corrections. The VCPS is physically and functionally separated from the spacecraft except for the electrical and telemetry interfaces. A GFE transtage provides the superstructure on which the VCPS is assembled. The subsystem consists of two 5 foot pound rocket engine assemblies, 4 propellant tanks, 2 latching valves, 2 fill and drain valves, a system filter, pressure transducer, gas and propellant manifolds and electrical heaters and thermostats. The RAE-B VCPS program covered the design, manufacture and qualification of one subsystem. This subsystem was to be manufactured, subjected to qualification tests; and refurbished, if necessary, prior to flight. The VCPS design and test program precluded the need for refurbishing the subsystem and the unit was delivered to GSFC at the conclusion of the program. Author

N74-15464*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FORTRAN PROGRAM TO GENERATE ENGINE INLET FLOW CONTOUR MAPS AND DISTORTION PARAMETERS
John H. Dicus Washington Feb. 1974 63 p refs
(NASA-TM-X-2967; E-7572) Avail: NTIS HC $3.50 CSCL 21E

A computer program is presented and described that generates jet engine inlet flow contour maps and inlet flow distortion parameters. The program input consists of an array of measurements describing the flow conditions at the engine inlet. User-defined distortion parameters may be calculated. Author

N74-15465*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FLIGHT VELOCITY EFFECTS ON JET NOISE OF SEVERAL VARIATIONS OF A 48-TUBE SUPPRESSOR INSTALLED ON A PLUG NOZZLE
Richard R. Burley and Verlon L. Head Washington Feb. 1974 38 p refs
(NASA-TM-X-2919; E-7513) Avail: NTIS HC $3.00 CSCL 21E

Because of the relatively high takeoff speeds of supersonic transport aircraft, it is important to know if the flight velocity affects the noise level of suppressor nozzles. To investigate this, a modified F-106B aircraft was used to conduct a series of flyover and static tests on a 48-tube suppressor installed on an uncooled plug nozzle. Comparison of flyover and static spectra indicated that flight velocity had little effect on the noise suppression of the 48-tube suppressor configuration. However, flight velocity adversely affected noise suppression of the 48-tube suppressor with an acoustic shroud and plug installed. Author

N74-15466*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FLIGHT VELOCITY EFFECTS ON JET NOISE OF SEVERAL VARIATIONS OF A TWELVE-CHUTE SUPPRESSOR INSTALLED ON A PLUG NOZZLE
Richard R. Burley and Albert L. Johns Washington Feb. 1974 38 p refs
(NASA-TM-X-2918; E-7449) Avail: NTIS HC $3.00 CSCL 21E

Because of the relatively high takeoff speeds of supersonic transport aircraft, it is important to know whether the flight velocity effects the noise level of suppressor nozzles. To investigate this, a modified F-106B aircraft was used to conduct a series of flyover and static tests on a 12-chute suppressor installed on an uncooled plug nozzle. Comparison of flyover and static spectra indicated that flight velocity adversely affected noise suppressions of the 12-chute configurations. Author

N74-15467# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE TESTING OF JET ENGINES, CHAPTERS 5 AND 6
L. S. Skubschevskii 6 Sep. 1973 69 p refs Transl. into ENGLISH from the publ. "Ispytaniya Vozdushno- Keakt ivnukh Dvigatele" USSR, 1972 115 p
(AF Proj. G101)
(AD-768492; FTD-MT-24-345-73) Avail: NTIS CSCL 21/5

The report describes the structural parts of jet engine test stands and explains the function of each part. GRA

N74-15468# Phillips Petroleum Co., Bartlesville, Okla. Research and Development Dept.
REDUCTION OF POLLUTANTS FROM AIRCRAFT TURBINE BY FUEL SELECTION AND PREVAPORIZATION Final Report, 14 Sep. 1972 - 14 Jun. 1973
H. T. Quigg Oct. 1973 184 p refs
(Contract N00140-72-C-6969)
(AD-769099; Rept-6607-73) Avail: NTIS CSCL 21/5

An investigation was conducted, using the Phillips 2-Inch combustor operating under conditions simulating those in modern aircraft turbine engines, to provide information on the effects of hydrocarbon type and fuel volatility on flame radiance and exhaust emissions. Fuels used in the investigation were a JP-5 for reference and ten pure hydrocarbons (normal, iso-, and cycloparaffins and aromatics) with various boiling points within each hydrocarbon type. Hydrogen content of the fuels ranged from 7.7 to 16.4 weight per cent. The effects of differences in physical properties of the fuels were minimized by prevaporization before introduction to the combustor and maximized by using pressure atomization for injection of fuel to the combustor. Inlet air humidity was included as an operating variable. Empirical equations, based on fuel and operating variables were developed for prediction of flame radiance, NO, NOx, CO, and smoke. (Modified author abstract) GRA

N74-15469# Marquardt Corp., Van Nuys, Calif.
FEASIBILITY OF RAMJET ENGINE TEST CAPABILITY ON THE HOLLOMAN SLED TRACK Technical Summary Report, May 1971 - Apr. 1973
Lester E. McTaggart Sep. 1973 119 p
(Contract F33615-71-C-1372; AF Proj. 3012)
(AD-769043; MR-S1267; AFAPL-TR-73-80) Avail: NTIS CSCL 21/5

Under a joint program between the 6585 Test Group/TK and the Ramjet and Laser Aerodynamics Division of the Aero Propulsion Laboratory, an existing monorail test sled was modified to accept the SCP/LASRM test vehicle. The necessary structural modifications were made to the SCP/LASRM hardware to withstand the applied loads imposed by the sled. The feasibility of ramjet engine test capability on the Holloman Sled Track was confirmed by comparison of ramjet performance data obtained during high speed sled tests to that available from previous ground freejet and flight tests with this engine. Propulsion performance data over the Mach range 2.3 to 2.5 at zero degree angle of attack were obtained from the sled tests.
Author (GRA)

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics, and 24 Physics, Atomic, Molecular, and Nuclear.

N74-15470 British Library Lending Div., Boston Spa (England).
ABSORPTION OF SOLAR ENERGY IN THE SEA
O. V. Kopelevich Aug. 1973 7 p refs Transl. into ENGLISH from the publ. "Funktsionirovanie Pelagicheskikh Soobshchestv Tropicheskikh Raionov Okeana: Mat. 44th Reisan-i supna "Vityaz" Moscow, 1971 p 35-38
(BLL-RTS-8051) Avail: British Library Lending Div., Boston Spa, Engl.: £0.60 or 2 BLL photocopy coupons

Calculations were made of the amount of solar energy absorbed by sea water at varying spectral intervals in relation to depth. Author

N74-15471 North Carolina Univ., Chapel Hill.
ENERGETIC PARTICLES DURING THE SOLAR PARTICLE EVENT OF 2 NOVEMBER 1969 Ph.D. Thesis
George Joseph Oliver 1973 124 p
Avail: Univ. Microfilms Order No. 73-26221

Particle fluxes were studied in the altitude range from 40 to 120 kilometers, using the Nike Javelin. Onboard the rocket were two detector systems. One of these detector systems was a three detector telescope assembly which was capable of detecting

electron, proton, alpha, and electromagnetic fluxes. The second of these detector systems contained a silicon avalanche detector designed to detect low energy electrons. Extensive studies of low energy electron spectra are made using information from both detector systems and references. The radiological hazard due to the alpha, proton, and electron fluxes is evaluated as a function of depth in tissue. The continuous energy distributions for the particulate radiations complicate the calculation of dose. The rate of energy loss is continuously changing as particles penetrate tissue. Dissert. Abstr

N74-15472*# Stanford Univ., Calif. Inst. for Plasma Research.

THERMALLY DRIVEN MASS FLOWS IN THE CONVECTION ZONE OF THE SUN

Geert C. Dijkhuis May 1973 118 p refs

(Grant NGL-05-020-272)

(NASA-CR-136505; SU-IPR-518) Avail. NTIS HC $8.00 CSCL 03B

A formulation of the fluid dynamics of convective regions is developed which leads to an analytical description of the solar rotation, the Evershed flow, and the supergranulation. The starting point of the present formulation is the mixing length picture of convective equilibrium, but the earlier point mass model for convective molecules is replaced here by a model with both inertia and intrinsic moment of inertia. This extension introduces three rotational degrees of freedom into the dynamics of individual convective molecules, which enter into the dynamical equations for a mixing length fluid in the form of a separate vector field which we term the spin field. It is shown that for convective molecules having a spherically symmetric mass distribution, the spin field is proportional to the local vorticity. Author

N74-15473# Observatorio Astronomico Municipal, Rosario (Argentina).

GENERAL CATALOG OF SUNSPOTS AND SUMMARY OF SOLAR ACTIVITY FOR 1972 [CATALOGO GENERAL DE MANCHAS SOLARES Y RESUMEN DE ACTIVIDAD, 1972]

1972 28 p In SPANISH; ENGLISH summary

(Contrib-7) Avail: NTIS HC $3.50

A catalog of observed sunspots during 1972 is presented. The duration and evolution of the activity are shown. Author

N74-15474*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

AN INTERPRETATION OF THE OBSERVED OXYGEN AND NITROGEN ENHANCEMENTS IN LOW ENERGY COSMIC RAYS

L. A. Fisk, B. Kozlovsky, and R. Ramaty Dec. 1973 10 p refs Submitted for publication

(NASA-TM-X-70564; X-660-73-383) Avail: NTIS HC $3.00 CSCL 03B

It is proposed that the enhancements of cosmic ray oxygen and nitrogen observed at approximately 10 MeV/nucleon could result from neutral interstellar particles which are swept into the solar cavity. This is caused by motion of the sun through the interstellar medium, and the particles are subsequently ionized and accelerated. Author

N74-15475*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE ANOMALOUS ABUNDANCE OF COSMIC RAY NITROGEN AND OXYGEN NUCLEI AT LOW ENERGIES

F. B. McDonald, B. J. Teegarden, J. H. Trainor, and W. R. Webber (New Hampshire Univ.) Dec. 1973 15 p refs

(NASA-TM-X-70566; X-660-73-392) Avail: NTIS HC $3.00 CSCL 03B

Recent measurements using a cosmic ray telescope on the Pioneer 10 spacecraft have revealed an anomalous spectrum of nitrogen and oxygen nuclei relative to other nuclei such as He and C, in the energy range 3-30 MeV/nuc. The intensity of nitrogen and oxygen nuclei is enhanced by a factor of up to 20 relative to their abundance in galactic or solar cosmic rays. Author

N74-15476*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

NEUTRON PROPAGATION AND 2.2 MeV GAMMA-RAY LINE PRODUCTION IN THE SOLAR ATMOSPHERE

H. T. Wang (Md. Univ., College Park) and R. Ramaty Jan. 1974 20 p refs

(Grant NGR-21-002-316)

(NASA-TM-X-70568; X-660-74-5) Avail: NTIS HC $3.00 CSCL 03B

The 2.2 MeV gamma ray line intensity from the sun was calculated using a Monte Carlo method for neutron propagation in the solar atmosphere. Detailed results are provided on the total gamma ray yield per neutron and on the time profile of the 2.2 MeV line from an instantaneous and monoenergetic neutron source. The parameters which have the most significant effects on the line intensity are the energies of the neutrons, the position of the neutron source on the sun, and the abundance of He-3 in the photosphere. For an isotropic neutron source which is not too close to the limb of the sun, the gamma ray yield is between about 0.02 to 0.2 photons per neutron, provided that the neutron energies are in the range 1 to 100 MeV and the ratio He-3/H is less than about .00005. Author

N74-15477# Lockheed Missiles and Space Co., Palo Alto, Calif.

SOME QUESTIONS OF SOLAR WIND SHOCKWAVE INTERACTION WITH EARTH'S MAGNETOSPHERE

S. A. Grib [1973] 6 p refs Transl. into ENGLISH from Geomagn. Aeron. (USSR), v. 13, no. 5, 1973 p 788-793

Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The interaction between shocks and the bow wave front and the magnetopause of the earth-sun line is examined in a magnetohydrodynamic approximation. It is shown that because of secondary interactions within some time interval after the shock's arrival, a rarefraction wave attaches account of the influence of the interplanetary field. Author

N74-15478# RAND Corp., Santa Monica, Calif.

FUEL FROM ORGANIC MATTER

Doris J. Dugas Oct. 1973 25 p refs

(P-5100) Avail: NTIS HC $3.25

It has been suggested frequently that the solar energy stored in green plants and organic wastes could be tapped to provide an alternative to the dwindling resources of fossil fuels. The advantage would be a fuel source that is renewable and available in our own time. This paper investigates the amounts of energy that might be made available from organic sources, the approximate cost of producing it and converting it to a convenient fuel, and some of the implications of a large-scale agro-energy industry. The discussion refers primarily to the United States, but the ideas could be adapted to other areas of the world. Author

N74-15479# Atomic Energy of Canada Ltd., Chalk River (Ontario). Chalk River Nuclear Labs.

COSMIC RAY NM-64 NEUTRON MONITOR DATA. 2 22.2 MONTHLY GRAPHS, MAY - AUGUST 1972

J. F. Steljes May 1973 86 p

(AECL-4354) Avail: AEC Depository Libraries HC $6.50; Atomic Energy of Can., Ltd., Chalk River HC $2.00

Uncorrected and barometer-corrected results from the cosmic-ray stations in Canada using equipment maintained by AECL are given in tabular form for the period from May to August 1972. Normalized graphs are given for the same period. Correction factors for the constant rates of drift of the barometers at each of the four stations are given. Detailed listings of the event of August 3-10 are included. Author NSA

N74-15480# Consiglio Nazionale delle Ricerche, Rome (Italy). Lab. di Ricerca e Tecnologia per lo Studio del Plasma nello Spazio.

A TECHNIQUE FOR THE STUDY OF SHORT TERM COSMIC RAY VARIATIONS. PART 1: THE ORIGIN OF SCATTER TECHNIQUE

L. R. Barnden Dec. 1971 74 p refs Sponsored in part by a Commonwealth of Australia Postgraduate Award

(LPS-71-29) Avail: NTIS HC $5.75

A theoretical method, the orgin-of-scatter technique, for calculating the count-rate variation of an earth based cosmic

ray detector given the number density distribution of cosmic rays in interplanetary space is introduced. The flux at earth which was last-scattered within a given volume element, when the relative cosmic ray number density is U = 1.0, was determined for a set of volume elements in interplanetary space. Because this flux is proportional to U, these quantities can be used as coefficients to yield the flux for any arbitrary U. By summing up all volume elements, the time dependent flux at earth for any number density distribution can be obtained. An expression for these origin-of-scatter coefficients was derived, and the required parameters were obtained from cosmic ray trajectories calculated in a spiral interplanetary magnetic field model. The effects of superposed magnetic field irregularities are effectively included in terms of a scattering mean free path. Results for four representative stations are given. Author (ESRO)

N74-15481# Consiglio Nazionale delle Ricerche, Rome (Italy). Lab. di Ricerca e Tecnologia per lo Studio del Plasma nello Spazio.
A TECHNIQUE FOR THE STUDY OF SHORT TERM COSMIC RAY VARIATIONS. PART 2: THE FORBUSH DECREASE
L. R. Barnden Dec. 1971 50 p refs
(LPS-71-30) Avail: NTIS HC $4.50

The results of applying the orgin-of-scatter technique to study Forbush decrease are presented. A simple step decrease in cosmic ray number density which propagates outwards from the Sun was chosen to represent the situation in interplanetary space at the time of such events. The origin-of-scatter technique was shown to yield synthetic Forbush decreases similar to those observed in practice. It was found that the form of modulation associated with the decrease is strongly dependent on the effective radial velocity of the number density step, the scattering mean free path in interplanetary space, and the geographic longitude of the observing station. The longitude dependence of modulation implies large anisotropies at earth in agreement with observation. In addition, it was concluded that north-south anisotropies will appear at times of Forbush decreases if the large scale interplanetary magnetic fields is inclined to the earth's equatorial plane. Author (ESRO)

N74-15482# Applied Scientific Research Corp. of Thailand, Bangkok.
THE FINE STRUCTURE OF THE SOLAR CHROMOSPHERE Annual Report, 1 Aug. 1971 - 31 Jan. 1973
Rawi Bhavilai Mar. 1973 19 p refs
(Grant DA-CRD-AFE-S92-544-68-G102; DA Proj. 2M0-61102-B-52B)
(AD-767746; ARDG(FE)-344-3; AR-3) Avail: NTIS CSCL 03/2

The design, construction and details of a 150 mm f/10 solar chromospheric telescope recently installed at the Department of Physics is described. The optical components, the Zeiss H-alpha Monochromator and the Acme cinecamera are placed on a 2.30 meter long spar mounted equatorially. Motion in hour angle is powered by a synchronous motor, while guiding is done through a set of differential gear driven by a servomotor responding to an error signal from the Zeiss Photoelectric Sun Guiding Tube. This also controls guiding in the declination axis. The telescope performs satisfactorily and is in continuous operation in the time-lapse cinematographic mode. The results of reduction of the data obtained in 1971 are presented. Isophotometric studies of the limb photographs confirm that bright mottles inside the limb corresponds to spicules just outside. On the disk, more evidences are obtained in contradiction to the idea that dark mottles are spicules. The bright streaks discovered by Bhavilai (1968) are confirmed. Apparent material motions in loops are found between dark mottles near the solar limb. Author (GRA)

N74-15483*# Stanford Univ., Calif. Inst. for Plasma Research.
PARTICLE ACCELERATION IN SOLAR FLARES
Peter A. Sturrock Sep. 1973 20 p refs Presented at 57th IAU Symp. on Coronal Disturbances, Australia, Sep. 1973
(Grant NGL-05-020-272; Contract N00014-67-A-0112-0062; NR Proj. 323-009)
(NASA-CR-136611; AD-767971; SU-IPR-541) Avail: NTIS HC $3.00 CSCL 03/2

A review of observational data supports the proposal that there are two distinct phases of particle acceleration in solar flares. Phase 1 is associated with the flash phase and is here interpreted as acceleration during field-line reconnection. Phase 2 is associated with Type II and Type IV radio bursts, and is ascribed to stochastic acceleration in the turbulent plasma behind a magnetohydrodynamic shock formed ahead of an ejected plasmoid. Author (GRA)

N74-15484# Weather Squadron (12th), Ent AFB, Colo
A REVIEW OF NEUTRAL LINE ANALYSIS TECHNIQUES
1 Jun. 1973 13 p
(AD-767215; Tech-Paper-73-9) Avail: NTIS CSCL 03/2

There are five basic H-Alpha structures that can be used for inferring neutral lines: filaments, filaments channels, arch filaments, plage corridors, and fibrils. They may be used singularly or in a combined form. This review briefly describes each of these five structures. Procedures (McIntosh) for inferring neutral lines are also discussed. Author (GRA)

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support, and 31 Space Vehicles.

N74-15485 British Library Lending Div., Boston Spa (England).
THE STATISTICS OF DOUBLE GALAXIES
I. D. Karachentsev [1973] 17 p refs Transl. into ENGLISH from Vestn. Kievsk. Univ. Ser. Astron. (Kiev), v. 12, 1970 p 103-114
(BLL-RTS-7946) Avail: British Library Lending Div., Boston Spa, Engl.: £1.60 or 5 BLL photocopy coupons

The visual magnitude of galaxies and the distance between them are used to formulate a statistical isolation criterion for determining physical pairs of galaxies by means of random optical observations of their radial velocities. Results show that luminosity and difference in radial velocity of galaxies decrease markedly in going from pairs with elliptical members through pairs of mixed members to those with spiral members. Conversely the mean linear distance between components increased. G.G.

N74-15486 Texas Univ., Austin.
OPTIMAL THREE DIMENSIONAL BOOST TRAJECTORIES FOR SHUTTLE-TYPE VEHICLES Ph.D. Thesis
Robert Golden Gottlieb 1973 122 p
Avail: Univ. Microfilms Order No. 73-26009

A hybrid numerical optimization method which combines the min H gradient method with a multiple pass perturbation method is developed and is then used to calculate optimal three dimensional boost trajectories for shuttle-type vehicles. The variant of the perturbation method uses a least squares estimate of the Jacobian matrix, relating changes in the initial Langrange multipliers to changes in the terminated boundary conditions. After s sufficient number of data sets (trajectories) were generated, a Jacobian matrix is estimated. A unique feature of the method is that it retains information from the best of the previously generated trajectories and does not start over with each iterate as does the standard perturbation method. Dissert. Abstr.

N74-15487 Texas Univ., Austin.
ABSOLUTE BRIGHTNESS TEMPERATURE MEASUREMENTS AT MILLIMETER WAVELENGTHS Ph.D. Thesis
Bobby Lee Ulich 1973 146 p
Avail: Univ. Microfilms Order No. 73-26098

Absolute brightness temperatures of the Sun, Moon, Mercury, Venus, Mars, Jupiter, and Saturn were measured at three millimeter wavelengths with a 4.88 meter diameter radio telescope. These and other data are used to determine the shape and absolute intensity of the millimeter spectra of the planets and are interpreted in terms of existing surface and atmospheric models. Radiative conduction in the Mercurian epilith is shown to be a relatively unimportant method of heat transfer in the region where the millimeter emission originates. The existence

of a thin layer of liquid water in the Martian topsoil is shown to be highly unlikely. The presence of apparent resonant absorption feature in the spectrum of Venus near 2 mm wavelength was confirmed. An unexpectedly high brightness temperature of Jupiter near 3 millimeters wavelength produces a complex milimeter spectrum. The spectrum of Saturn is flat at short millimeter wavelengths and thus Saturn is the best planetary calibration source for relative measurements. Dissert. Abstr.

N74-15488 California Inst. of Tech., Pasadena.
THE STRUCTURE OF COMPACT RADIO SOURCES AT 606 MHZ Ph.D. Thesis
George Harber Purcell, Jr. 1973 214 p
Avail: Univ. Microfilms Order No. 73-26476

Long baseline interferometry was used to study the structure of thirteen compact radio sources at 606 MHz. The baseline was 3324 kilometers long and nearly east-west in orientation, so that the maximum angular resolution was about a hundredth of a second of arc for each source. There were two series of observations, made on June 29 to July 1, 1971, and February 3 to 6, 1972. For most of the sources observed in each session, the correlated flux was measured from ten to forty times over a wide range of hour angle, with a standard error for each measurement of about 0.12 flux unit. Simple source models were then fitted to the data and compared to the models proposed by other observers. The data for most of the sources were found to be consistent with models containing an elliptical halo concentric with an unresolved core. The observations of 3C 84, 3C 279, and 3C 345 show evidence of weak structure at relatively large distances from the strong central components.
Dissert. Abstr.

N74-15489*# Texas Univ., Austin.
STUDY OF OPTICAL PROPERTIES OF X-RAY SOURCES Final Report, 1 Jul. 1972 - 30 Jun. 1973
Paul A. VandenBout 30 Jun. 1973 5 p refs
(Grant NGR-44-012-209)
(NASA-CR-136551) Avail: NTIS HC $3.00 CSCL 03A

A report is presented of R and D of the optical properties of X-ray sources. The topics discussed include: (1) simultaneous optical and X-ray observations; (2) coronal line search in cygnus loop; (3) Her X-1 = HZ Her observations; (4) Cyg X-1 observations; and (5) Sco X-1 radio companion observations. K.M.M.

N74-15490*# Northwestern State Univ., Natchitoches, La.
PHOTOGEOLOGIC MAPPING OF MERIDIANI SINUS REGION FROM MARINER 6 AND 7 IMAGERY Final Technical Report
Rene A. DeHon [1973] 17 p refs
(Grant NGR-19-013-002)
(NASA-CR-136588) Avail: NTIS HC $3.00 CSCL 03B

Photogeologic mapping of Mariner photographs characterizes major stratigraphic units of the Martian equatorial region. The low resolution photomosaic ship across Meridiani Sinus Deucalionus Regio is divided into regional map units based on albedo and crater density. High resolution frames reveal map units defined by varying surface texture, crater densities, and degree of crater sharpness. Mariner photographs provide clear evidence of eolian action and channelization by fluid flow. Author

N74-15491# Academy of Sciences (USSR), Ryazan.
RESULTS OF OBSERVATIONS OF SCIENTIFIC EARTH SATELLITES. POLET 1 1963 43 1; VISUAL OBSERVATIONS, EQUATORIAL COORDINATES (1950.0), MARCH - JUNE 1971 [REZULTATY NABLYUDENIY ISKUSSTVENNYKH SPUTNIKOV ZEMLI. POLET 1 1963 43 1; VIZUALNYYE NABLYUDENIYA, EKVATORIALNYYE COORDINATY (1950.0), MART - IYUN 1971 G]
1973 66 p In RUSSIAN
(Rept-13(153)) Avail: NTIS HC $5.50

Data are presented for visual observations of scientific earth satellites, which were made at Soviet stations in 1971. Author

N74-15492# Academy of Sciences (USSR), Ryazan.
RESULTS OF OBSERVATIONS OF SCIENTIFIC EARTH SATELLITES. EXPLORER 19 1963 53 1; VISUAL OBSERVATIONS, HORIZONTAL COORDINATES, JANUARY - JULY 1971 [REZULTATY NABLYUDENIY ISKUSSTVENNYKH SPUTNIKOV ZEMLI. EKSPLORER 19 1963 53 1; VIZUALNYYE NABLYUDENIYA, GORIZONTALNYYE KOORDINATY, YANVAR - IYUL 1971 G]
[1973] 63 p In RUSSIAN
(Rept-6(146)) Avail: NTIS HC $5.25
For abstract, see N74-15491.

N74-15493# Academy of Sciences (USSR), Ryazan.
RESULTS OF OBSERVATIONS OF SCIENTIFIC EARTH SATELLITES. SAMOS 2 1961 01 1, POLET 1 1963 43 1, EXPLORER 32 1966 44 1, EXPLORER 39 1968 66 1; VISUAL OBSERVATIONS, HORIZONTAL COORDINATES, MARCH - DECEMBER 1971 [REZULTATY NABLYUDENIY ISKUSSTVENNYKH SPUTNIKOV ZEMLI. SAMOS 2 1961 01 1, POLET 1 1963 43 1, EKSPLORER 32 1966 44 1, EKSPLORER 39 1968 66 1; VIZUALNYYE NABLYUDENIYA GORIZONTALNYYE KOORDINATY, MART - DEKABR 1971 G]
1973 76 p In RUSSIAN
(Rept-12(152)) Avail: NTIS HC $6.00
For abstract, see N74-15491.

N74-15494# Academy of Sciences (USSR), Ryazan.
RESULTS OF OBSERVATIONS OF SCIENTIFIC EARTH SATELLITES. SAMOS 2 1961 01 1; VISUAL OBSERVATIONS, EQUATORIAL COORDINATES (1950.0), MARCH - SEPTEMBER 1971 [REZULTATY NABLYUDENIY ISKUSSTVENNYKH SPUTNIKOV ZEMLI. SAMOS 2 1961 1 1; VIZUALNYYE NABLYUDENIYA, EKVATORIALNYYE KOORDINATY (1950.0), MART - SENTYABR 1971 G]
1973 64 p In RUSSIAN
(Rept-11(151)) Avail: NTIS HC $5.25
For abstract, see N74-15491.

N74-15495# Academy of Sciences (USSR), Ryazan.
RESULTS OF OBSERVATIONS OF SCIENTIFIC EARTH SATELLITES. EXPLORER 19 1963 53 1, EXPLORER 39 1968 66 1; VISUAL OBSERVATIONS, EQUATORIAL COORDINATES (1950.0), OCTOBER - NOVEMBER 1971 [REZULTATY NABLYUDENIY ISKUSSTVENNYKH SPUTNIKOV ZEMLI. EKSPLORER 19 1963 53 1, EKSPLORER 39 1968 66 1; VIZUALNYYE NABLYUDENIYA, EKVATORIALNYYE KOORDINATY (1950.0), OKTYABR - NOYABR 1971 G]
1972 61 p In RUSSIAN
(Rept-10(150)) Avail: NTIS HC $5.25
For abstract, see N74-15491.

N74-15496# Academy of Sciences (USSR), Ryazan.
RESULTS OF OBSERVATIONS OF SCIENTIFIC EARTH SATELLITES. EXPLORER 32 1966 44 1, EXPLORER 39 1968 66 1; VISUAL OBSERVATIONS, EQUATORIAL COORDINATES (1950.0), MARCH - DECEMBER 1971, APRIL - SEPTEMBER 1971 [REZULTATY NABLYUDENIY ISKUSSTVENNYKH SPUTNIKOV ZEMLI. EKSPLORER 32 1966 44 1, EKSPLORER 39 1968 66 1; VIZUALNYYE NABLYUDENIYA, EKVATORIALNYYE KOORDINATY (1950.0), MART - DEKABR 1971 G, APREL - SENTYABR 1971 G]
1972 61 p In RUSSIAN
(Rept-9(149)) Avail: NTIS HC $5.25
For abstract, see N74-15491.

N74-15497# Academy of Sciences (USSR), Ryazan.
RESULTS OF OBSERVATIONS OF SCIENTIFIC EARTH SATELLITES. EXPLORER 19 1963 53 1; VISUAL OBSERVATIONS, EQUATORIAL COORDINATES (1950.0), AUGUST - SEPTEMBER 1971 [REZULTATY NABLYUDENIY ISKUSSTVENNYKH SPUTNIKOV ZEMLI. EKSPLORER 19 1963 53 1; VIZUALNYYE NABLYUDENIYA EKVATORIALNYYE KOORDINATY (1950.0), (AVGUST-SENTYABR 1971 G)]
1972 63 p In RUSSIAN
(Rept-8(148)) Avail: NTIS HC $5.25
For abstract, see N00-00BAD.

N74-15498# Academy of Sciences (USSR), Ryazan.
RESULTS OF OBSERVATIONS OF SCIENTIFIC EARTH SATELLITES. EXPLORER 19 1963 53 1; VISUAL OBSERVATIONS, HORIZONTAL COORDINATES, JULY - OCTOBER

1971 [REZULTATY NABLYUDENIY ISKUSSTVENNYKH SPUTNIKOV ZEMLI. EKSPLORER 19 1963 53 1; VIZUAL-NYYE NABLYUDENIYA, GORIZONTALNYYE KOORDINATY (IYUL-OKTYABR 1971 G)]
[1973] 67 p In RUSSIAN
(Rept-7(147)) Avail: NTIS HC $5.50
For abstract, see N74-15491.

N74-15499# Committee on Space Research (COSPAR), Paris (France).
SEVENTEENTH PLENARY MEETING AND ASSOCIATED ACTIVITIES (SCIENTIFIC PROGRAM AND LOCAL ARRANGEMENTS)
[1973] 38 p Conf. to be held in Sao Paulo, Brazil, 17 Jun. - 1 Jul. 1974
Avail: NTIS HC $4.00
Scheduled workshops, symposia, and open meetings of COSPAR are announced. Information concerning visas, vaccinations, travel, and accommodations for the meetings are included. F.O.S.

N74-15500# Universidad Nacional de Colombia, Bogota. Facultad de Ciencias.
ANNUAL OF THE NATIONAL ASTRONOMICAL OBSERVATORY FOR 1973 [ANUARIO DEL OBSERVATORIO ASTRONOMICO NACIONAL, 1973]
1973 109 p In SPANISH
Avail: NTIS HC $7.50
The astronomical catalog is presented. Data presented include ephemerides for the sun and planets, eclipses, and the calendar for 1973. The right ascension and declination of the stars are also tabulated. Transl. by F.O.S.

N74-15501*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACE FLIGHT OPERATIONS
Nov. 1973 13 p Revised
(Contract NAS7-100)
(NASA-CR-136562; JPL-TM-32-444-Rev-2) Avail: NTIS HC $3.00 CSCL 22A
Under contract to the National Aeronautics and Space Administration, the Jet Propulsion Laboratory (JPL) of the California Institute of Technology manages and operates the ground facilities required to support unmanned spacecraft in missions to the moon, the planets, and beyond. A worldwide network of tracking stations, known as the Deep Space Network (DSN), was established to communicate with spacecraft. The Mission Control and Computing Center at JPL houses the mission control personnel and the computer facilities that command and control spacecraft in flight. Communications between the MCCC and the tracking stations, as well as communications among the stations, are the responsibility of the DSN Ground Communications Facility, which connects all parts of the ground system with telephone, teletype, and high-speed data lines. The operation of the ground system is outlined, and the various missions which were successfully supported are described. Author

N74-15502# Bureau of Mines, Twin Cities, Minn. Twin Cities Mining Research Center
SHEAR TESTING OF SIMULATED LUNAR SOIL IN ULTRAHIGH VACUUM
B. V. Johnson, W. W. Roepke, and K. C. Strebig 1973 21 p refs
(NASA Order R-09-040-001)
(NASA-CR-136568; BM-RI-7814) Avail: NTIS HC $3.25 CSCL 08M
Equipment and techniques were developed to conduct soil shear tests in a simulated lunar environment. Shear tests performed with this equipment in ultrahigh vacuum and controlled laboratory atmosphere showed that simulated lunar soil increased in strength in the simulated lunar environment. Author

N74-15503# Joint Publications Research Service, Arlington, Va.
SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE NO. 315
28 Dec. 1973 76 p refs Transl. into ENGLISH from various Soviet bloc publications
(JPRS-60879) Avail: NTIS HC $6.00
Translations and abstracts are presented of articles on meteorology, oceanography, upper atmosphere and space research, astronomy and terrestrial geophysics, covering both science news and formal scientific reports. Author

N74-15504*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SYSTEM DEFINITION FOR COMETARY EXPLORER: A MISSION TO INTERCEPT THE COMETS GRIGG-SKJELLERUP (1977) AND GIACOBINI-ZINNER (1979)
Nov. 1973 51 p refs
(NASA-TM-X-70561; X-701-73-376) Avail: NTIS HC $4.75 CSCL 22A
Its purpose was to define a low cost dual-comet intercept mission. The study established the framework for investigating future ballistic intercept missions to comets. Author

N74-15505*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LONG AND SHORT ARC ALTITUDE DETERMINATION FOR GEOS-C
D. Koch, P. Argentiero, and W. D. Kahn Nov. 1973 25 p refs
(NASA-TM-X-70558; X-591-73-368) Avail: NTIS HC $3.25 CSCL 22C
The accuracy with which the GEOS-C altitude may be estimated over long (7 day) and short (40 minute) orbital arcs is investigated. Over the long are excellent agreement was attained between a simulation of the orbit determination process and a covariance analysis. Both approaches yielded RMS altitude errors of about 1.5 meters over the Caribbean calibration area and approximately 7.5 meters overall. The geopotential was identified as the largest error source. For the short arc, the covariance analysis revealed that the propagated altitude error is linearly dependent upon station survey component errors which are also the largest source of altitude errors. An Appendix contains the mathematics of covariance analysis as applied to orbit determination. Author

N74-15506*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE EARLY HISTORY OF THE LUNAR INCLINATION
David Parry Rubincam Dec. 1973 178 p refs
(NASA-TM-X-70554; X-592-73-328) Avail: NTIS HC $11.00 CSCL 03C
The effect of tidal friction on the inclination of the lunar orbit to the earth's equator for earth-moon distances of less than 10 earth radii is examined. The results obtained bear on a conclusion drawn by Gerstenkorn and others which has been raised as a fatal objection to the fission hypothesis of lunar origin, namely, that the present nonzero inclination of the moon's orbit to the ecliptic implies a steep inclination of the moon's orbit to the earth's equatorial plane in the early history of the earth-moon system. This conclusion is shown to be valid only for particular rheological models of the earth. The earth is assumed to behave like a highly viscous fluid in response to tides raised in it by the moon. The moon is assumed to be tideless and in a circular orbit about the earth. The equations of tidal friction are integrated numerically to give inclination of the lunar orbit as a function of earth-moon distance. Author

N74-15507*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE OCTOBER 1973 NASA MISSION MODEL ANALYSIS AND ECONOMIC ASSESSMENT
Jan. 1974 84 p refs
(NASA-TM-X-64798) Avail: NTIS HC $6.25 CSCL 22A
Results are presented of the 1973 NASA Mission Model Analysis. The purpose was to obtain an economic assessment of using the Shuttle to accommodate the payloads and requirements as identified by the NASA Program Offices and the DoD. The 1973 Payload Model represents a baseline candidate set of future payloads which can be used as a reference base for planning purposes. The cost of implementing these payload programs utilizing the capabilities of the shuttle system is analyzed and compared with the cost of conducting the same payload effort using expendable launch vehicles. There is a net benefit

of 14.1 billion dollars as a result of using the shuttle during the 12-year period as compared to using an expendable launch vehicle fleet. Author

N74-15508*# Techtran Corp., Glen Burnie, Md.
ON THE THRESHOLD OF THE JOINT FLIGHT
N. N. Gurovskiy, O. Z. Gazenko, B. B. Yegorov, and N. Zykov Washington NASA Jan. 1974 12 p Transl. into ENGLISH from Nauka i Zhizn (Moscow), no. 10, Oct. 1973
(Contract NASw-2485)
(NASA-TT-F-15269) Avail: NTIS HC $3.00 CSCL 22A

Three interviews with Soviet personalities involved in the joint Soviet-American space flight to be held in July 1975 are presented. Cooperation between the scientists of the U.S.S.R. and the U.S. in the field of space biology and medicine is discussed. The forthcoming three-volume work 'Fundamentals of Space Biology and Medicine' which represents a joint effort by the scientists of the two nations is outlined. The various aspects of the joint flight itself are discussed taking up technical problems involving bilingual inscriptions, compatibility of medicines, problems of personal hygiene and the necessity for training in the use of both systems. Author

N74-15509# Groupe de Recherches de Geodesie Spatiale, Paris (France).
LITERAL COUPLING EXPRESSION TERMS IN THE ANALYTICAL THEORY OF GEOPOTENTIAL MOTION OF ARTIFICIAL SATELLITES [EXPRESSIONS ANALYTIQUES LITTERALES DES TERMES DE COUPLAGE DANS LA THEORIE ANALYTIQUE DU MOUVEMENT DES SATELLITES ARTIFICIELS SOUS L'ACTION DU POTENTIEL TERRESTRE]
X. Berger Jun. 1973 65 p refs In FRENCH; ENGLISH summary
(GRGS-Bull-8) Avail: NTIS HC $5.25

Some terms called coupling terms are due to the simultaneous presence of zonal and tesseral harmonics. A mathematical model for coupling terms in artificial satellite motion is presented using the Lagrange equation developed by means of the Taylor formula. A comparison of the analytical method and numerical integration applied to calculation of the D1C satellite has shown that the secular terms in omega 4 can be neglected. The performance of the analytical theory for studying long periodic effects is emphasized. ESRO

N74-15510# Owens Valley Radio Observatory, Pasadena, Calif.
A SEARCH FOR OD IN THE GALACTIC CENTER
Diego A. Cesarsky, Richard M. Crutcher, and Mark Allen 1973 10 p refs
(Contract N00014-67-A-0094-0019)
(AD-767367; Rept-1973-14) Avail: NTIS CSCL 03/2

The authors have unsuccessfully searched for the delta F = 0 lambda doublet transitions of the doublet Pi(3/2), J=32 state of the OD. The resulting upper limit of the OD/OH column density ratio is 1/400. (Modified author abstract) GRA

N74-15511*# California Univ., Riverside. Inst. of Geophysics and Planetary Physics.
JUPITER'S RADIATION BELTS
Kent G. Stansberry and R. Stephen White Jun. 1973 59 p refs
(Grant NGR-05-008-022; Contracts N00014-69-A-0200-5001; N00014-69-A-0200-5004; NR Proj. 387-047)
(NASA-CR-136580; AD-767050; IGPP-UCR-73-23; TR-10) Avail: NTIS HC $5.00

Fluxes of electrons and protons in Jupiter's radiation belts are calculated with the source, radial diffusion inward from the solar wind, and the loss, synchrotron radiation. The calculations are tested against the measured radiowave wavelength distribution, the radiowave distribution with distance from Jupiter and the degree of polarization of the radiowaves. The Fokker-Planck equation is solved using the method of Farley and Walt with the flux fixed at the outer boundary and zero flux at Jupiter's surface. It was found in agreement with Brice and McDonough, Jacques and Davis, and Birmingham et al. that the usual magnetic and electric diffusions, that vary as L sup 10 and L sup 6, respectively, are insufficient to furnish the required electrons and that the diffusion driven by ionospheric winds of Brice and McDonough is strong enough to furnish Jupiter's belts. (Modified author abstract) GRA

N74-15512# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A SECOND ORDER METHOD FOR COMPUTING AN OPTIMAL REENTRY TRAJECTORY USING NUMERICAL DERIVATIVES M.S. Thesis
David Richards Jun. 1973 84 p refs
(AD-768381; GGC/EE/73-16) Avail: NTIS CSCL 22/3

The primary purpose of the study was to investigate a second order method using numerical derivatives to converge to an optimal set of initial costates that would produce an optimal re-entry trajectory. A second objective of the research was to test the computational method by computing a minimum total heat input trajectory (two dimensional) for a lifting body. It was assumed that the vehicle could attain a maximum lift-to-drag of 2.0 during its desent from a near earth orbit. The initial states are known, the initial costates are unknown, and only the final altitude at a fixed final range is specified. The second order method uses the first and second difference equations to iterate on corrections to an arbitrarily chosen set of initial costates. The corrections are based on minimizing a scalar terminal error function. The results indicate that the numerical integration errors limit too severely the accuracy to which the second partials of the terminal errors with respect to the initial costates could be estimated. (Modified author abstract) GRA

N74-15513# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
BALLISTIC ENERGY PARAMETER CONTROLLER FOR ATMOSPHERIC REENTRY OF A LIFTING BODY M.S. Thesis
Dennis Navin Jun. 1973 95 p refs
(AD-768380; GGC/EE/73-11) Avail: NTIS CSCL 22/3

A preliminary investigation was conducted on the usefulness of the nondimensional ballistic energy parameter Q in a control scheme for the atmospheric reentry of a lifting body with a maximum L/D of 2. A feasible control scheme was developed that allowed onboard calculation of the angle of attack which was used as the control. The control scheme was used over a wide spread of surface ranges while still meeting criteria on heating rate, deceleration and obtaining a desired final velocity. The final altitude was near that desired. The control scheme is flexible in that it has the capability of updating itself continually as its states become better known and if the control becomes saturated for a part of the reentry trajectory the scheme will pick up again when the vehicle returns to a controllable state. The development was in two dimensional space and comparisons were made with desirable reference trajectories. Author (GRA)

N74-15514# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
DETERMINATION OF REENTRY CORRIDOR WIDTH BASED ON HEATING M.S. Thesis
John J. Kessler and Paul D. Tofte Jun. 1973 146 p refs
(AD-768377; GGG/EE/73-8) Avail: NTIS CSCL 22/3

The report contains a two-dimensional study of the reentry corridor for lifting body reentry vehicles with available maximum lift-to-drag ratios of 1, 1.5, 2 and 3. The initial velocity range investigated is from 7.9 km/sec to 23.7 km/sec which encompasses reentry missions from near earth to interplanetary return. Two studies of the reentry corridor are presented: a constant control study where a specific constant control, angle of attack, was applied from reentry to capture; an optimal control method, differential dynamic programming, was used to determine if the corridor width could be extended from that determined by the constant control by applying an optimal time varying control from reentry to capture. The results of the two studies show that the constant control window is a good approximation of the optimal control window. The boundaries of the reentry corridor are defined by capture and heating rate constraints. (Modified author abstract) GRA

N74-15515# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
BALLISTIC SKIP GUIDANCE FOR ATMOSPHERIC REENTRY M.S. Thesis

Melvin L. Nagel Jun. 1973 62 p refs
(AD-768379; GGC/EE/73-10) Avail: NTIS CSCL 22/3

The feasibility of a re-entry guidance scheme that uses ballistic flight to attain a variable surface range is investigated. The equations of motion are derived, and the re-entry trajectory is divided into four phases: pull up, skipout, ballistic, and terminal. The pull up, skipout, and terminal phases are within the atmosphere, while the ballistic phase is outside the atmosphere. The conjugate gradient optimization method is used in the skipout phase to determine the re-entry vehicle control needed to achieve the desired initial ballistic phase conditions. The cost function uses the errors between the actual trajectory and a reference trajectory which is obtained by projecting a ballistic path into the atmosphere. The equations for the reference trajectory are presented. Ballistic theory is discussed and a parametric selection technique is presented as a means of determining the ballistic parameters needed for a specific range. An optimal control solution is found for one set of ballistic initial conditions.
Author (GRA)

N74-15516# Army Missile Command, Redstone Arsenal, Ala.
DESCRIPTION OF POINT MASS AND THREE DEGREE OF FREEDOM TRAJECTORY PROGRAMS
James R. Burt, Jr. and Mickie P. Stamps 18 Sep. 1973 30 p
(DA Proj. 1M2-62303-A-214)
(AD-768773; RD-TR-73-31) Avail: NTIS CSCL 16/2

The report describes two Basic language programs written for the Hewlett Packard Model 9830 digital computer. The first program described computes a 2-degree of freedom or point mass trajectory for a rocket which may have a boost, sustain, and coast phase. The second program has 3 degrees of freedom: range, altitude, and pitch angle. A flat earth is assumed and atmospheric properties vary with altitude. Two constant thrust levels and up to three drag tables may be used. The output data may be tabulated and/or plotted on the HP 9802A calculator plotter. A Basic listing of the programs and sample outputs are included in the report. Author (GRA)

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N74-15517*# Carnegie-Mellon Univ., Pittsburgh, Pa. Applied Space Sciences Program.
ATTITUDE DYNAMIC OF SPIN-STABILIZED SATELLITES WITH FLEXIBLE APPENDAGES Final Report
Marc L. Renard Sep. 1973 266 p refs
(Grant NGR-39-087-026)
(NASA-CR-132902) Avail: NTIS HC $15.50 CSCL 22B

Equations of motion and computer programs have been developed for analyzing the motion of a spin-stabilized spacecraft having long, flexible appendages. Stability charts were derived, or can be redrawn with the desired accuracy for any particular set of design parameters. Simulation graphs of variables of interest are readily obtainable on line using program FLEXAT. Finally, applications to actual satellites, such as UK-4 and IMP-1 have been considered. Author

N74-15518*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE SPACE SHUTTLE PAYLOAD PLANNING WORKING GROUPS. VOLUME 1: ASTRONOMY Final Report
May 1973 80 p
(NASA-TM-X-69409) Avail: NTIS HC $6.00 CSCL 22B

The space astronomy missions to be accomplished by the space shuttle are discussed. The principal instrument is the Large Space Telescope optimized for the ultraviolet and visible regions of the spectrum, but usable also in the infrared. Two infrared telescopes are also proposed and their characteristics are described. Other instruments considered for the astronomical observations are: (1) a very wide angle ultraviolet camera, (2) a grazing incidence telescope, (3) Explorer-class free flyers to measure the cosmic microwave background, and (4) rocket-class instruments which can fly frequently on a variety of missions. The stability requirements of the space shuttle for accomplishing the astronomy mission are defined. Author

N74-15519*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE SPACE SHUTTLE PAYLOAD PLANNING WORKING GROUPS. VOLUME 2: ATMOSPHERIC AND SPACE PHYSICS Final Report
May 1973 79 p
(NASA-TM-X-69408) Avail: NTIS HC $6.00 CSCL 22B

The findings of the Atmospheric and Space Physics working group of the space shuttle mission planning activity are presented. The principal objectives defined by the group are: (1) to investigate the detailed mechanisms which control the near-space environment of the earth, (2) to perform plasma physics investigations not feasible in ground-based laboratories, and (3) to conduct investigations which are important in understanding planetary and cometary phenomena. The core instrumentation and laboratory configurations for conducting the investigations are defined.
Author

N74-15520*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE SPACE SHUTTLE PAYLOAD PLANNING WORKING GROUPS. VOLUME 3: HIGH ENERGY ASTROPHYSICS Final Report
May 1973 97 p
(NASA-TM-X-69407) Avail: NTIS HC $7.00 CSCL 22B

The findings of the High Energy Astrophysics working group of the space shuttle payload planning activity are presented. The objectives to be accomplished during space shuttle missions are defined as: (1) X-ray astronomy, (2) hard X-ray and gamma ray astronomy, and (3) cosmic ray astronomy. The instruments and test equipment required to accomplish the mission are identified. Recommendations for managing the installation of the equipment and conducting the missions are included. Author

N74-15521*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE SPACE SHUTTLE PAYLOAD PLANNING WORKING GROUPS. VOLUME 4: LIFE SCIENCES Final Report
May 1973 76 p
(NASA-TM-X-69406) Avail: NTIS HC $6.00 CSCL 22B

The findings of the Life Sciences working group of the space shuttle payload planning activity are presented. The objectives of the Life Sciences investigations are: (1) to continue the research directed at understanding the origin of life and the search for extraterrestrial evidence of life, (2) biomedical research to understand mechanisms and provide criteria for support of manned flight, (3) technology development for life support, protective systems, and work aids for providing environmental control, and (4) to study basic biological functions at all levels or organization influenced by gravity, radiation, and circadian rhythms. Examples of candidate experimental schedules and the experimental package functional requirements are included. Author

N74-15522*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE SPACE SHUTTLE PAYLOAD PLANNING WORKING GROUPS. VOLUME 5: SOLAR PHYSICS Final Report
May 1973 101 p
(NASA-TM-X-69405) Avail: NTIS HC $7.25 CSCL 22B

The findings of the Solar Physics working group of the space shuttle payload planning activity are presented. The areas to be investigated by the solar physics experiments are: (1) the production of mechanical energy in the subphotospheric layers and its transport and dissipation in the upper layers of the atmosphere, (2) the mass flux from the subphotospheric layers into the chromosphere and corona and beyond the solar wind, (3) solar acitvity and its relationship to magnetic fields, and (4) the production of solar flares. The approach to be followed in conducting the experiments and the equipment required are defined. Author

N74-15523*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE SPACE SHUTTLE PAYLOAD PLANNING WORKING GROUPS. VOLUME 6: COMMUNICATIONS AND NAVIGATION Final Report
May 1973 76 p
(NASA-TM-X-69462) Avail: NTIS HC $6.00 CSCL 22B

The findings of the Communications and Navigation working group of the space shuttle payload planning activity are presented. The basic goals to be accomplished are to increase the use of space systems and to develop new space capabilities for providing communication and navigation services to the user community in the 1980 time period. Specific experiments to be conducted for improving space communication and navigation capabilities are defined. The characteristics of the experimental equipment required to accomplish the mission are discussed. Author

N74-15524*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE SPACE SHUTTLE PAYLOAD PLANNING WORKING GROUPS. VOLUME 7: EARTH OBSERVATIONS Final Report
May 1973 66 p
(NASA-TM-X-69461) Avail: NTIS HC $5.50 CSCL 22B

The findings of the Earth Observations working group of the space shuttle payload planning activity are presented. The objectives of the Earth Observation experiments are: (1) establishment of quantitative relationships between observable parameters and geophysical variables, (2) development, test, calibration, and evaluation of eventual flight instruments in experimental space flight missions, (3) demonstration of the operational utility of specific observation concepts or techniques as information inputs needed for taking actions, and (4) deployment of prototype and follow-on operational Earth Observation systems. The basic payload capability, mission duration, launch sites, inclinations, and payload limitations are defined. Author

N74-15525*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE SPACE SHUTTLE PAYLOAD PLANNING WORKING GROUPS. VOLUME 8: EARTH AND OCEAN PHYSICS Final Report
May 1973 30 p
(NASA-TM-X-69460) Avail: NTIS HC $3.50 CSCL 22B

The findings and recommendations of the Earth and Ocean Physics working group of the space shuttle payload planning activity are presented. The requirements for the space shuttle mission are defined as: (1) precision measurement for earth and ocean physics experiments, (2) development and demonstration of new and improved sensors and analytical techniques, (3) acquisition of surface truth data for evaluation of new measurement techniques, (4) conduct of critical experiments to validate geophysical phenomena and instrumental results, and (5) development and validation of analytical/experimental models for global ocean dynamics and solid earth dynamics/earthquake prediction. Tables of data are presented to show the flight schedule estimated costs, and the mission model. Author

N74-15526*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE SPACE SHUTTLE PAYLOAD PLANNING WORKING GROUPS: VOLUME 9: MATERIALS PROCESSING AND SPACE MANUFACTURING Final Report
May 1973 73 p
(NASA-TM-X-69459) Avail: NTIS HC $5.75 CSCL 22B

The findings and recommendations of the Materials Processing and Space Manufacturing group of the space shuttle payload planning activity are presented. The effects of weightlessness on the levitation processes, mixture stability, and control over heat and mass transport in fluids are considered for investigation. The research and development projects include: (1) metallurgical processes, (2) electronic materials, (3) biological applications, and (4)nonmetallic materials and processes. Additional recommendations are provided concerning the allocation of payload space, acceptance of experiments for flight, flight qualification, and private use of the space shuttle. Author

N74-15527*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE SPACE SHUTTLE PAYLOAD PLANNING WORKING GROUPS. VOLUME 10: SPACE TECHNOLOGY Final Report
May 1973 96 p
(NASA-TM-X-69457) Avail: NTIS HC $7.00 CSCL 22B

The findings and recommendations of the Space Technology group of the space shuttle payload planning activity are presented. The elements of the space technology program are: (1) long duration exposure facility, (2) advanced technology laboratory, (3) physics and chemistry laboratory, (4) contamination experiments, and (5) laser information/data transmission technology. The space technology mission model is presented in tabular form. The proposed experiments to be conducted by each test facility are described. Recommended approaches for user community interfacing are included. Author

N74-15528*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE SPACE SHUTTLE PAYLOAD PLANNING WORKING GROUPS: EXECUTIVE SUMMARIES Final Report
May 1973 51 p
(NASA-TM-X-69464) Avail: NTIS HC $4.75 CSCL 22B

The findings of a space shuttle payload planning group session are presented. The purpose of the workshop is: (1) to provide guidance for the design and development of the space shuttle and the spacelab and (2) to plan a space science and applications program for the 1980 time period. Individual groups were organized to cover the various space sciences, applications, technologies, and life sciences. Summaries of the reports submitted by the working groups are provided. Author

N74-15529*# Rockwell International Corp., Downey, Calif. Space Div.
SPACE SHUTTLE ORBITER FRACTURE CONTROL PLAN
Mar. 1973 21 p refs
(Contract NAS9-14000)
(NASA-CR-136554; SD73-SH-0082) Avail: NTIS HC $3.25 CSCL 22B

The criteria are presented for preventing space shuttle structural failure associated with crack initiation or propagation during fabrication, test, handling, and the operational life of the vehicle. The criteria discussed include: engineering responsibilities, assurance management, production, operation and test, procurement, critical parts selection, design, and structural analysis. F.O.S.

N74-15530*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
UNSTEADY AERODYNAMIC ANALYSIS OF SPACE SHUTTLE VEHICLES. PART 2: STEADY AND UNSTEADY AERODYNAMICS OF SHARP-EDGED DELTA WINGS Final Technical Report
Lars E. Ericsson and J. Peter Reding Aug. 1973 134 p refs
(Contract NAS8-28130)
(NASA-CR-120123; LMSC-D352320-Pt-2) Avail: NTIS HC $8.75 CSCL 22B

An analysis of the steady and unsteady aerodynamics of sharp-edged slender wings has been performed. The results show that slender wing theory can be modified to give the potential flow static and dynamic characteristics in incompressible flow. A semiempirical approximation is developed for the vortex-induced loads, and it is shown that the analytic approximation for sharp-edged slender wings gives good prediction of experimentally determined steady and unsteady aerodynamics at M = 0 and M = 1. The predictions are good not only for delta wings but also for so-called arrow and diamond wings. The results indicate that the effects of delta planform lifting surfaces can be included in a simple manner when determining elastic launch vehicle dynamic characteristics. For Part 1 see (N73-32763). Author

N74-15531*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
UNSTEADY AERODYNAMIC ANALYSIS OF SPACE SHUTTLE VEHICLES. PART 3: BOOSTER INTERFERENCE EFFECTS Final Technical Report
J. Peter Reding and Lars E. Ericsson Aug. 1973 103 p refs
(Contract NAS8-28130)
(NASA-CR-120124; LMSC-D352320-Pt-3) Avail: NTIS

HC $7.25 CSCL 22B

An investigation of the interference flow field on the space-shuttle boast configuration has been made. The results show that the interference effects can dominate the shuttle aerodynamics. Vortices shed from shock-induced flow separations on the forward portion of the vehicle affect the aerodynamic loads on the aft portion of the booster. Thus, the forebody and aft-body flow fields are coupled. This coupling and the associated time lag due to the finite convection speed of the vortices furnish a mechanism whereby the unsteady aerodynamics can cause undamping of certain low frequency elastic modes of the booster. A preliminary order-of-magnitude analysis of the aeroelastic stability of the shuttle booster indicates that negative aerodynamic damping could occur for at least one bending mode and be of sufficient magnitude to dominate the structural damping. The implication of these results, (with the possibility of undamped oscillations leading to structural failure), is serious enough to warrant further, more detailed analysis. Author

N74-15532*# Lockheed Missiles and Space Co., Sunnyvale, Calif.

UNSTEADY AERODYNAMIC ANALYSIS OF SPACE SHUTTLE VEHICLES. PART 4: EFFECT OF CONTROL DEFLECTIONS ON ORBITER UNSTEADY AERODYNAMICS

Final Technical Report

J. Peter Reding and Lars E. Ericsson Aug. 1973 66 p refs (Contract NAS8-28130)

(NASA-CR-120125; LMSC-D352320-Pt-4) Avail: NTIS HC $5.50 CSCL 22B

The unsteady aerodynamics of the 040A orbiter have been explored experimentally. The results substantiate earlier predictions of the unsteady flow boundaries for a 60 deg swept delta wing at zero yaw and with no controls deflected. The test revealed a previously unknown region of discontinuous yaw characteristics at transonic speeds. Oilflow results indicate that this is the result of a coupling between wing and fuselage flows via the separated region forward of the deflected elevon. In fact, the large leeward elevon deflections are shown to produce a multitude of nonlinear stability effects which sometimes involve hysteresis. Predictions of the unsteady flow boundaries are made for the current orbiter. They should carry a good degree of confidence due to the present substantiation of previous predictions for the 040A. It is proposed that the present experiments be extended to the current configuration to define control-induced effects. Every effort should be made to account for Reynolds number, roughness, and possible hot-wall effects on any future experiments. Author

N74-15533# Committee on Aeronautical and Space Sciences (U. S. Senate).

SPACE SHUTTLE PAYLOADS, PART 1

Washington GPO 1974 237 p Hearing before Comm. on Aeronaut. and Space Sci., 93d Congr., 1st Sess., 30 Oct. 1973 Avail: SOD HC $1.75 CSCL 22B

The testimony concerning space missions, payloads, and traffic for space shuttles is reported. Mission models are discussed for the astronomy, physics, planetary exploration, and space technology programs. F.O.S.

N74-15534# Joint Publications Research Service, Arlington, Va.

FUTURE AND PAST SOVIET AND AMERICAN SPACE TECHNOLOGY

V. Glushko 20 Dec. 1973 11 p Transl. into ENGLISH from Aviats. i Kosmonavt. (Moscow), no. 10, Oct. 1973 p 30-31 (JPRS-60824) Avail: NTIS HC $3.00

The problems involved in transferring personnel from the orbiting space stations of the United States and Russian spacecraft are discussed. The main problem concerns the differences in atmospheric pressure and oxygen content of the spacecraft environments. Methods for conducting a safe transfer of personnel are discussed, with emphasis on avoiding problems with the bends. A history of the development of Russian rocketry and space mission capability is presented. Author

N74-15535*# Scientific Translation Service, Santa Barbara, Calif.

FROM SPACESHIPS TO ORBITING STATIONS: SECOND EDITION

A. Yu. Dmitriyev, ed., V. P. Denisov, A. A. Yermilov, B. I. Zhelyabin, A. V. Kirsanov, I. L. Leonidov, V. A. Polyakov, A. A. Timonin, A. M. Tumanov, and G. S. Narimanov Washington NASA Dec. 1973 135 p Transl. into ENGLISH of the book "Ot Kosmicheskikh Korabley - k Orbital'nymn Stantsiyam" (2nd Ed., Revised and Expanded) Moscow, Mashinostr., 1971 p 1-113 (Contract NASw-2035)

(NASA-TT-F-812) Avail: NTIS HC $4.50 CSCL 22B

The Soviet manned space program is discussed. The main stages of development of Soviet cosmonautics are considered, as well as the program for the manned spacecraft Vostok, Voskhod and Soyuz, and the orbital research station Salyut. The construction and equipment of the spacecraft, and their use on the earth and in flight are described. A description is given of the first orbital space station o the Soyuz spacecraft, as well as its operation and the experiments performed when the crew changed from one spacecraft to another in open space. The development of methods for assembling a station and performing scientific studies, and also the scientific station Salyut, on which the Soviet cosmonauts lived for several days are described. The book also discusses the future prospects for cosmonautics. Author

N74-15536*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

APOLLO EXPERIENCE REPORT: THERMAL PROTECTION SUBSYSTEM

James E. Pavlosky and Leslie G. St.Leger Washington Jan. 1974 25 p refs

(NASA-TN-D-7564; JSC-S-383) Avail: NTIS HC $2.75 CSCL 22B

The Apollo command module was the first manned spacecraft to be designed to enter the atmosphere of the earth at lunar-return velocity, and the design of the thermal protection subsystem for the resulting entry environment presented a major technological challenge. Brief descriptions of the Apollo command module thermal design requirements and thermal protection configuration, and some highlights of the ground and flight testing used for design verification of the system are presented. Some of the significant events that occurred and decisions that were made during the program concerning the thermal protection subsystem are discussed. Author

N74-15537*# Chrysler Corp., New Orleans, La.

EXPERIMENTAL INVESTIGATIONS OF AN 0.0405 SCALE SPACE SHUTTLE CONFIGURATION 3 ORBITER TO DETERMINE SUBSONIC STABILITY CHARACTERISTICS. VOLUME 1: OA21A

B. W. Cameron and A. J. Ritschel Nov. 1973 783 p (Contract NAS9-13247)

(NASA-CR-128792; DMS-DR-2053-Vol-1) Avail: NTIS HC $41.25 CSCL 22B

Experimental aerodynamic investigations were conducted in a low speed wind tunnel from May 21 through June 4 and from June 18 through June 25, 1973 on a 0.0405 scale -139B model Space Shuttle Vehicle (SSV) orbiter. The purpose of the test was to investigate the longitudinal and lateral-directional subsonic aerodynamic characteristics of the proposed PRR Space Shuttle orbiter. Emphasis was placed on component buildup effects, elevon, rudder, body flaps, rudder flare effectiveness, and canard and speed brake development. Angles of attack from -4 deg. to 24 deg. and angles of sideslip of -10 deg. to 10 deg. were tested. Static pressures were recorded on the base. The aerodynamic force balance results are presented in plotted and tabular form. Author

N74-15538*# Chrysler Corp., New Orleans, La. Data Management Services.

RESULTS OF TESTS OA12 AND IA9 IN THE AMES RESEARCH CENTER UNITARY PLAN WIND TUNNELS ON AN 0.030-SCALE MODEL OF THE SPACE SHUTTLE VEHICLE 2A TO DETERMINE AERODYNAMIC LOADS. VOLUME 4

R. H. Spangler (Rockwell Intern., Downey, Calif.) Oct. 1973 956 p 18 Vol. (Contract NAS9-13247)

(NASA-CR-128794-vol-4; DMS-DR-2032-Vol-4) Avail: NTIS HC $50.00 CSCL 22B

Tests were conducted in wind tunnels during April and May 1973, on an 0.030-scale replica of the Space Shuttle Vehicle Configuration 2A. Aerodynamic loads data were obtained at Mach numbers from 0.6 to 3.5. The investigation included tests on the integrated (launch) configuration and on the isolated orbiter (entry configuration). The integrated vehicle was tested at angles of attack and sideslip from -8 degrees to +8 degrees. The isolated orbiter was tested at angles of attack from -15 degrees to +40 degrees and angles of sideslip from -10 degrees to +10 degrees as dictated by trajectory considerations. The effects of orbiter/external tank incidence angle and deflected control surfaces on aerodynamic loads were also investigated. Author

N74-15539*# Chrysler Corp., New Orleans, La.
RESULTS OF TESTS OA12 AND IA9 IN THE AMES RESEARCH CENTER UNITARY PLAN WIND TUNNELS ON AN 0.030-SCALE MODEL OF THE SPACE SHUTTLE VEHICLE 2A TO DETERMINE AERODYNAMIC LOADS, VOLUME 5
R. H. Spangler (Rockwell Intern. 2, Downey, Calif.) Oct. 1973 1000 p
(Contract NAS9-13247)
(NASA-CR-128794-Vol-5; DMS-DR-2032-Vol-5) Avail: NTIS HC $52.00 CSCL 22B

Charts indicating pressure distribution for space shuttle components are included. For complete abstract, see N74-15538.

N74-15540*# Chrysler Corp., New Orleans, La. Data Management Services.
RESULTS OF TESTS OA12 AND IA9 IN THE AMES RESEARCH CENTER UNITARY PLAN WIND TUNNELS ON AN 0.030-SCALE MODEL OF THE SPACE SHUTTLE VEHICLE 2A TO DETERMINE AERODYNAMIC LOADS, VOLUME 6
R. H. Spangler (Rockwell Intern., Downey, Calif.) Oct. 1973 871 p 18 Vol
(Contract NAS9-13247)
(NASA-CR-128794-Vol-6; DMS-DR-2032-Vol-6) Avail: NTIS HC $45.75 CSCL 22B

For abstract see, N74-15538.

N74-15541*# Chrysler Corp., New Orleans, La. Data Management Services.
RESULTS OF TESTS OA12 AND IA9 IN THE AMES RESEARCH CENTER UNITARY PLAN WIND TUNNELS ON AN 0.030 SCALE MODEL OF THE SPACE SHUTTLE VEHICLE 2A TO DETERMINE AERODYNAMIC LOADS, VOLUME 7
R. H. Spangler (Rockwell Intern., Downey, Calif.) Nov. 1973 908 p 18 Vol
(Contract NAS9-13247)
(NASA-CR-128794-Vol-7; DMS-DR-2032-Vol-7) Avail: NTIS HC $47.50 CSCL 22B

Tests were conducted in wind tunnels during April and May 1973, on an 0.030-scale replica of the Space Shuttle Vehicle Configuration 2A. Aerodynamic loads data were obtained at Mach numbers from 0.6 to 3.5. The investigation included tests on the integrated (launch) configuration and on the isolated orbiter (entry configuration). The integrated vehicle was tested at angles of attack and sideslip from -8 deg. The isolated orbiter was tested at angles of attack from -15 deg to +40 deg and angles of sideslip from -10 deg to +10 deg as dictated by trajectory considerations. The effects of orbiter/external tank incidence angle and deflected control surfaces on aerodynamic loads were also investigated. Author

N74-15542*# Chrysler Corp., New Orleans, La.
RESULTS OF TESTS OA12 AND IA9 IN THE AMES RESEARCH CENTER UNITARY PLAN WIND TUNNELS OF AN 0.030 SCALE MODEL OF THE SPACE SHUTTLE VEHICLE 2A TO DETERMINE AERODYNAMIC LOADS, VOLUME 8
R. H. Spangler (Rockwell Intern., Downey, Calif.) Nov. 1973 1051 p
(Contract NAS9-13247)
(NASA-CR-128794-Vol-8; DMS-DR-2032-Vol-8) Avail: NTIS HC $6.75 CSCL 22B

Tabulated pressure data are included for the tests. For complete abstract, see N74-15538.

N74-15543*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
A SYSTEMS PLAN FOR AN EARTH AND OCEAN DYNAMICS SATELLITE APPLICATIONS PROGRAM
Joseph W. Siry Nov. 1970 48 p
(NASA-TM-X-70547; X-550-70-473) Avail: NTIS HC $4.50 CSCL 22B

A system for investigating phenomena associated with the earth's dynamical and crustal motions, and the sea surface is described. The proposed observing systems include the following facilities: (1) A network of fundamental stations, whose locations and motions, including polar, variations in the earth's rotational rate, and crustal motions, are determined by very long baseline interferometry, relative to the basic reference system of radio stars. The sites are all NASA Goddard stations with the exception of Kashima, Japan, a facility which has participated extensively in the ATS program. (2) A system of Geopause spacecraft in nearly circular polar orbits, normal to the ecliptic at a distance of about five earth radii with a period on the order of two thirds of a day. Author

N74-15544*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
A GEOPAUSE SATELLITE SYSTEM CONCEPT
Joseph W. Siry Apr. 1971 53 p refs Presented at 3d Intern. Symp. on the use of Artificial Satellites for Geodesy, Washington, D. C., Apr. 1971; sponsored by the Am. Geophys. Union Submitted for publication
(NASA-TM-X-70548; X-550-71-503) Avail: NTIS HC $4.75 CSCL 22B

A typical Geopause satellite orbit has a 14 hour period, a mean height of about 4.6 earth radii, and is nearly circular, polar, and normal to the ecliptic. At this height only a relatively few gravity terms have uncertainties corresponding to orbital perturbations above the decimeter level. The orbit is at the geopotential boundary, the geopause. The few remaining environmental quantities which may be significant can be determined by means of orbit analysis and accelerometers. The Geopause satellite system also provides the tracking geometry and coverage needed for determining the orbit, the tracking system biases and the station locations. Five or more fundamental stations well distributed in longitude can view Geopause over the North Pole. Geopause also provides the basic capability for satellite-to-satellite tracking of drag-free satellites for mapping the gravity field and altimeter satellites for surveying the sea surface topography. Author

N74-15545*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
SPACECRAFT CONTROL SECTION FOR THE IMPROVED SMALL ASTRONOMY SATELLITE (SAS)
Marjorie R. Townsend Jan. 1974 46 p
(NASA-TM-X-70569; X-405-74-7) Avail: NTIS HC $4.50 CSCL 22B

The upgraded spacecraft control section for the Small Astronomy Satellite is able to point its thrust axis to any direction in space; it can also spin or slow its outer body rotation to zero for star-locked pointing of side viewing experiments. A programmable telemetry system and delayed command system enhance the inherent capability of a spacecraft designed to be used for a variety of experiments, each of which can be built independently and attached just prior to final acceptance testing and launch. The design of this new spacecraft, whose first launch is scheduled for 1975, is provided in sufficient detail to permit the reader to ascertain its suitability for specific experiments. A summary of the spacecraft characteristics, project reliability requirements, and environmental test conditions are included in the appendices. Author

N74-15546*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
SERT D SPACECRAFT STUDY
[1974] 233 p
(NASA-TM-X-71494) Avail: NTIS HC $13.75 CSCL 22B

The SERT D (Space Electric Rocket Test - D) study defines a possible spacecraft project that would demonstrate the use of electric ion thrusters for long-term (5 yr) station keeping and attitude control of a synchronous orbit satellite. Other mission

objectives included in the study were: station walking to satellite rendezvous and inspection, use of low cost attitude sensing system, use of an advanced solar array orientation and slip ring system, and an ion thruster integrated directly with a solar array power source. The SERT D spacecraft, if launched, will become SERT 3 the third space electric thruster test. Author

N74-15547*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TADPOLE SATELLITE
Jan. 1974 36 p
(NASA-TM-X-71498; E-7861) Avail: NTIS HC $4.00 CSCL 22B

A low cost synchronous orbit satellite to evaluate small mercury bombardment ion thruster applications is described. The ion thrusters provide the satellite with precise north-south and east-west stationkeeping capabilities. In addition, the thrusters are used to unload the reaction wheels used for attitude control and for other purposes described in the report. The proposed satellite is named TADPOLE. (Technology Application Demonstration Program of Low Energy). Author

N74-15548# European Space Research Organization, Paris (France).
STRUCTURAL AND THERMAL TESTS. THEIR EVOLUTION AND PRESENT TRENDS. VOLUME 3: THERMAL TESTS
Jun. 1973 468 p refs Partly in ENGLISH and partly in FRENCH Proc. of a Symp. held at Noordwijk, Neth., 4-7 Dec. 1972 3 Vol.
(ESRO-SP-95-Vol-3) Avail: NTIS HC $25.50

Selected papers on spacecraft model testing, adjustment of thermal mathematical models, source of errors of thermal testing, infrared and solar simulation, performance and accuracy of thermal balance tests, problems and proposed solutions, equipment specifications, and test facility equipment are presented. For volumes 1 and 2 see N74-14536 and N74-14558. For individual titles, see N74-15549 through N74-15571.

N74-15549 Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).
ASPECTS OF THE OPTIMIZATION OF SPACECRAFT THERMAL MODEL TESTING
J. Gulpen *In* ESRO Struct. and Thermal Tests, Vol. 3 Jun. 1973 p 1-19 (For availability see N74-15548 06-31)

The scope of the spacecraft thermal model verification tests, statistical parameters, estimation theory and thermal network correction programs, and the application of thermal network correction programs to thermal model adjustment are reviewed. Author (ESRO)

N74-15550 European Space Research and Technology Center, Noordwijk (Netherlands). Structures Div.
THERMAL MODEL VERIFICATION TESTS AND ADJUSTMENT OF THERMAL MATHEMATICAL MODELS
A. Accensi *In* ESRO Struct. and Thermal Tests, Vol. 3 Jun. 1973 p 21-35 refs (For availability see N74-15548 06-31)

The methods of optimizing thermal model testing are described. They are concentrated in two fields. The first is concerned with making the thermal model and the test equipment reliable and insensitive to intermittent test facility failures. The second is concerned with reducing the test time. The S/C thermal models have a flight-type structure and a flight-type thermal control sybsystem. ESRO

N74-15551 Selenia S.p.A., Rome (Italy).
COMPUTER EVALUATION OF THE SHADOWS CAST ON AN ANTENNA SYSTEM BY A SPACECRAFT BODY OR PART OF IT FOR THERMAL MODELING
S. DiPaolo and M. Passerini *In* ESRO Struct. and Thermal Tests, Vol. 3 Jun. 1973 p 37-45 (For availability see N74-15548 06-31)

A measuring method is presented for computer evaluating the percentage of shadow cast on part of a satellite body by other satellite body parts (even of complex shape), when the satellite body is subjected to sun exposure. This method is based on the evaluation of the common area between the projected contours of the shadowed body and the shadowing body (from the sun vector direction) on a common virtual screen perpendicular to the sun vector. Such a method permits a rapid and exact evaluation of the radiating energy to each element of an external body mounted on a spacecraft, taking into account the shadows cast on it by other bodies for a more exact thermal balance. As an example the above method was employed for evaluating the shadows cast on a S/C antenna by the S/C body itself; another application might be given by the evaluation of the shadows cast on solar array panels by complex S/C bodies (antennas, booms, etc.) both for spinning and three axis stabilized satellites. Author (ESRO)

N74-15552 National Aerospace Lab., Amsterdam (Netherlands).
THERMAL CONDUCTIVITY OF METALLIC HONEYCOMB SANDWICH PANELS
A. A. M. Delil, J. F. Heemskerk, and D. H. W. Daniels *In* ESRO Struct. and Thermal Tests, Vol. 3 Jun. 1973 p 47-68 refs (For availability see N74-15548 06-31)

The thermal conductivity of a metallic honeycomb sandwich panel was measured in the three characteristic directions. The measurements were carried out in a space simulation chamber. The results agreement with values calculated for a simplified model. Author (ESRO)

N74-15553 European Space Research and Technology Center, Noordwijk (Netherlands). Structures and Thermal Div.
QUALIFICATION OF ESRO 4 THERMAL CONTROL SUB-SYSTEM [LA QUALIFICATION DU SOUS-SYSTEME DE CONTROLE THERMIQUE DU SATELLITE ESRO 4]
J. F. Redor *In* ESRO Struct. and Thermal Tests, Vol. 3 Jun. 1973 p 69-92 In FRENCH (For availability see N74-15548 06-31)

The qualification tests of the satellite thermal control subsystems are presented. Measurement results are compared to predicted temperatures, and methods (procedures) for the correction of the mathematical model are described. ESRO

N74-15554 Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (West Germany).
METHODS AND ACCURACY OF TEMPERATURE MEASUREMENTS FOR THERMAL TESTING
H. Frey and J. Reimann *In* ESRO Struct. and Thermal Tests, Vol. 3 Jun. 1973 p 93-105 (For availability see N74-15548 06-31)

There are inputs for thermocouples, strain gages and voltages, digital inputs and outputs, and a PCM channel. The IABG has a direct connection by cables from the satellite to the input of the MEVA, so only alternating spin is possible. The signals of the thermocouples are scanned by a low level FET multiplexer and are digitized after being amplified. The highest scan frequency is 10 kHz. Many programs are available for recording and quick look. All measured values can be changed by a special transducer and plotted in each requested format. Each value can also be compared with a list of critical values or previous scans. All scans of each channel can be plotted by a special program called sort, thus each channel can be controlled over a long time. Author (ESRO)

N74-15555 Societe Nationale Industrielle Aerospatiale, Cannes (France).
SOURCES OF ERROR IN THERMAL TESTS: HEAT LOSSES [SOURCES D'ERREUR DANS LES ESSAIS THERMIQUES-CAS PARTICULIER DES FUITES THERMIQUES]
M. Girard *In* ESRO Struct. and Thermal Tests, Vol. 3 Jun. 1973 p 107-123 In FRENCH (For availability see N74-15548 06-31)

The characteristics of some measurements and tests carried out at a thermal vacuum testing laboratory were described. Various types of heat loss including radiative, conductive, and dynamic heat losses as well as solutions adopted to prevent these losses were outlined. ESRO

N74-15556 European Space Research and Technology Center, Noordwijk (Netherlands). Engineering and Testing Div.
MEASUREMENT OF THE INFRARED BACKGROUND IN THE ESTEC SPACE CHAMBERS HBF 2 AND HBF 3 c11
G. Saenger *In* ESRO Struct. and Thermal Tests, vol. 3 Jun. 1973 p 125-135 refs (For availability see N74-15548 06-31)

In estimating the equilibrium temperature of an S/C in orbit, the infrared heat input of the shroud may be neglected. This also applies to the simulation of eclipse phase, since the S/C does not cool down to an extremely low temperature. More information on infrared background is required. Author (ESRO)

N74-15557 Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (West Germany).
CALIBRATION AND CHARACTERISTIC MEASUREMENTS OF A SOLAR SIMULATOR FACILITY FOR THERMAL BALANCE TESTS **c11**
H. Nuss *In* ESRO Struct. and Thermal Tests, Vol. 3 Jun. 1973 p 137-155 (For availability see N74-15548 06-31)

Specified values for the solar simulator and the results before, during, and after the thermal balance tests with the Aeros thermal model, prototype and flight unit are described. They include: local distribution measurement of radiation intensity in the reference plane, spectral distribution measurement, solar simulator calibration, and intensity monitoring during test. Thermal stability in simulated space conditions of the collimation mirror, which consists of 1000 mosaic elements was also investigated.
Author (ESRO)

N74-15558 Centre National d'Etudes Spatiales, Toulouse (France).
EVALUATION OF CHARACTERISTICS OF A SOLAR SIMULATOR REQUIRED FOR THERMAL VACUUM TESTS [EVALUATION DES CARACTERISTIQUES D'UN SIMULATEUR SOLAIRE NECESSAIRES A LA CONDUITE D'UN ESSAI VIDE-SOLEIL] **c11**
D. Dabadie *In* ESRO Struct. and Thermal Tests, Vol. 3 Jun. 1973 p 157-174 In FRENCH (For availability see N74-15548 06-31)

The control of a satellite thermal model in a space environment chamber implies a more accurate definition of solar radiation characteristics such as solar flux determination, irradiation level, the spectral distribution, and decollimation of the radiation beam. The measurement methods applied to the control of the CNES (Toulouse) space environment chamber are outlined. ESRO

N74-15559 European Space Research and Technology Center, Noordwijk (Netherlands). Engineering and Testing Div.
METHODS TO DETERMINE INTENSITY LEVELS AT POINTS OF AREAS WITHIN THE TEST VOLUME OF THE DIVERGENT SOLAR SIMULATOR OF THE HEAT BALANCE FACILITY HBF 3 AT ESTEC **c11**
P. W. Brinkmann *In* ESRO Struct. and Thermal Tests, Vol. 3 Jun. 1973 p 175-200 refs (For availability see N74-15548 06-31)

The HBF 3 solar simulator is described, and the main beam parameters are presented. The information is related to local intensity distribution data within the test volume. It is shown that the intensity distribution curve can be approximated by an analytical formula. Methods are given for deriving the relative intensity levels on points or areas of specimen surfaces from the intensity distribution measured in the reference plane.
Author (ESRO)

N74-15560 Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (West Germany).
RESULTS OF THE APPLICATION OF A 30 kW HIGH PRESSURE XENON LAMP IN THE IABG SOLAR SIMULATOR FOR THERMAL BALANCE TESTING **c11**
H. J. Geil, H. Nuss, and R. Pfeifer *In* ESRO Struct. and Thermal Tests, Vol. 3 Jun. 1973 p 201-216 (For availability see N74-15548 06-31)

In order to perform a thermal balance test on the ESRO satellite HEOS A2 prototype in the IABG 3m space simulation chamber the irradiation intensity had to be increased in such a way that, according to the test requirements, a test plane of 1.8m diameter could be illuminated with 1.1 solar constant for 170 hrs. One possible solution to the problem consisted in using one or several water-cooled high intensity xenon lamps of 20 to 30 kW instead of the existing air-cooled 6.5 kW high pressure lamps. It is concluded that water-cooled high intensity xenon lamps can be used for solar simulation. The experiment shows how the existing facility can be equipped with those lamps, in order to increased the the performance. Author (ESRO)

N74-15561 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany).
CONTROL OF RADIOMETER CALIBRATION CURVES BY COMPARISON MEASUREMENTS IN PERIODICALLY FIXED INTERVALS **c11**
W. Ley *In* ESRO Struct. and Thermal Tests, Vol. 3 Jun. 1973 p 217-229 (For availability see N74-15548 06-31)

Sudden changes of the calibration curves, as well as drifting effects, can be detected with sufficient accuracy by comparison measurements. Since a Kendall Mark 4 high intensity radiometer, usable as a primary standard, is available, absolute calibrations up to 30 solar constants are also possible. Author (ESRO)

N74-15562 Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (West Germany).
THERMAL BALANCE TESTING WITH SOLAR SIMULATION AND VARIABLE INFRARED HEATING FOR FIRST-ORDER APPROXIMATION OF EARTH AND ALBEDO RADIATION WITH THE FLIGHT UNIT OF AEROS **c11**
J. Reimann and H. Staatsmann (Dornier System, Friedrichshafen, West Ger.) *In* ESRO Struct. and Thermal Tests, Vol. 3 Jun. 1973 p 231-261 (For availability see N74-15548 06-31)

Some methods for generating the net heat input to the satellite are presented and discussed. For the test on the Aero flight, unit method employing heated black surface was selected. Three different runs were made with the test equipment: (1) run without specimen to qualify the heater for leak tightness and adjustment; (2) solar simulation on the Aeros thermal model; and (3) solar simulation test with the Aeros flight unit.
Author (ESRO)

N74-15563 Fiat S.p.A., Turin (Italy).
EXPERIMENTAL COMPARISON BETWEEN INFRARED AND SOLAR SIMULATION TEST PHILOSOPHIES IN THE LIGHT OF THE TESTS CARRIED OUT ON THE SIRIO THERMAL MODEL
P. L. DegliEsposti and B. Strim *In* ESRO Struct. and Thermal Tests, Vol. 3 Jun. 1973 p 263-299 (For availability see N74-15548 06-31)

Solar simulation tests, based on complex facilities, give high quality results in a nearly exact simulation of the space environment. The IR tests are based on relatively simple facilities for thermal simulation of the satellite temperature field. A practical evaluation of the two methods with respective capabilities and interactions was performed on the occasion of the development of Sirio satellite thermal control subsystem. Author (ESRO)

N74-15564 Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).
INFRARED TEST TECHNIQUES DEVELOPED FOR THE HELIOS SPACECRAFT
J. Gulpen and W. Lorenz *In* ESRO Struct. and Thermal Tests, Vol. 3 Jun. 1973 p 301-33 (For availability see N74-15548 06-31)

The infrared test technique for testing the Helios solar probe at intensities equivalent to up to 16 solar-constants is described. The technique to the measurement of heat input into a solar irradiated aperture is presented. Test results are compared to solar simulation tests. Author (ESRO)

N74-15565 Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (West Germany).
FACILITY FOR HIGH INTENSITY THERMAL BALANCE TESTING USING THE INFRARED CANISTER METHOD **c11**
J. Reimann *In* ESRO Struct. and Thermal Tests, Vol. 3 Jun. 1973 p 335-349 (For availability see N74-15548 06-31)

The thermal shroud is provided with gaseous nitrogen to attain temperatures in the range from 100 to 360 K. The maximum heat load is 45 kW. The GN2-cycle is described, and some data of consumption are given. Titanium sublimation pumps were installed for operation in the high vacuum range. The effective pumping speed is about 100,000 l/s in the test volume. The pumping system is completed by ion getter pumps to pump noble gases. This pumping group is arranged in the test chamber below the shroud to minimize the loss of the pumping speed by conduction. The calibration test for Helios thermal model and the high intensity test for different thermal loads from 1 to

16 SC with the infrared canister method are discribed. Various problems, such as dealing with reflections from the shroud, are discussed. Author (ESRO)

N74-15566 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany).
THE SIMULATION OF HIGH IRRADIANCES IN THE SPACE SIMULATION INSTITUTE OF THE DFVLR: POSSIBILITIES AND EXPERIENCES c11
R. Naehle. *In* ESRO Struct. and Thermal Tests, Vol. 3 Jun. 1973 p 351-363 (For availability see N74-15548 06-31)

The distance between test specimen and the virtual light source is reduced, along with the irradiated area by using additional lenses. The use of attenuators, is featured which permits the utilization of systems of high efficiency for lower irradiances. The change of uniformity on the test area which is conditioned by changing the irradiation over a wide range is reported previous experiences and special problems of testing with high irradiances are discussed. Author (ESRO)

N74-15567 Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
CRITICAL CONSIDERATIONS ON PERFORMANCE AND EVALUATION OF THERMAL TESTS WITH THE GERMAN RESEARCH SATELLITES AZUR AND AEROS
W. J. Schwarzott. *In* ESRO Struct. and Thermal Tests, Vol. 3 Jun. 1973 p 365-381 refs (For availability see N74-15548 06-31)

The thermal design of Aeros and Azur satellites is reviewed. The main subjects are computerized test evaluation procedures and inaccuracies in thermal testing which arise from the shape of the solar beam, effective environmental temperature, and representative node temperatures measurement. Author (ESRO)

N74-15568 European Space Research and Technology Center, Noordwijk (Netherlands). Testing and Engineering Div.
RESIDUAL GAS AND OUTGASSING MEASUREMENTS DURING THE THERMAL BALANCE TESTS OF THE TD SATELLITE
G. Sanger and A. K. Franz. *In* ESRO Struct. and Thermal Tests, Vol. 3 Jun. 1973 p 383-419 refs (For availability see N74-15548 06-31)

The thermal balance tests of the TD satellite had to be carried out in an oil-free vacuum to avoid contamination, especially on two astrophysical experiments. For this reason, the original pumping system of the HBF 3 had to be replaced by titanium sublimation and ion getter pumps. The mass spectrometric analysis of the residual gas proved that the content of organic compounds was reduced by two orders of magnitude compared with the previous pumping system. It could also be demonstrated that some compounds were outgassed by the S/C at the initial phase. A consistent use of space qualified materials and components led to a negligible low partial pressure of organic compounds in the residual gas. Author (ESRO)

N74-15569 European Space Research and Technology Center, Noordwijk (Netherlands). Quality and Reliability Div.
DETECTION OF ORGANIC CONTAMINATION ON SURFACES (OF VACUUM FACILITIES AND SPACECRAFT) BY INFRARED SPECTROSCOPY TECHNIQUES
A. Zwaal. *In* ESRO Struct. and Thermal Tests, Vol. 3 Jun. 1973 p 421-430 (For availability see N74-15548 06-31)
(ESRO-PSS-15/QRM-05T (ESTEC))

Procedures are laid down for implementing direct and indirect methods of contamination monitoring by infrared spectroscopy directions are given for the interpretation of the results. Author (ESRO)

N74-15570 Bosch (Robert) G.m.b.H., Stuttgart (West Germany).
EXPERIENCE IN THE USE OF WATER-COOLED HIGH-POWER LAMPS FOR SOLAR SIMULATION c11
J. Artmann, H. Haug, and F. Prinzhausen. *In* ESRO Struct. and Thermal Tests, Vol. 3 Jun. 1973 p 431-441 (For availability see N74-15548 06-31)

The use of water cooled, high power xenon lamps was considered in relation to the air cooled, zenon high pressure lamps. Considering bad spectral fit, these air cooled lamps (mostly 6.5 kW) showed many advantages (servicing, monitoring, construction, optical system). The operation of water cooled, high power lamps is reported, including the use of a high power lamp unit in the IABG HEOS test and extensive efficiency measurements. Author (ESRO)

N74-15571 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany).
MEASUREMENT OF THERMAL ERRORS DURING SPACE SIMULATION IN THE IABG FACILITY c11
H. J. Geil (Industrieanlagen-Betriebsges.), H. Nuss (Industrieanlagen-Betriebsges.), Pieper (Dornier System), W. Hallmann, K. Kramp, and H. P. Schmidt. *In* ESRO Struct. and Thermal Tests, Vol. 3 Jun. 1973 p 443-457 (For availability see N74-15548 06-31)

In calculating the temperatures occuring during space simulation tests, deviations appear between measure and computed temperatures as a result of unavoidable simplifications of the analytical node model and discrepancies between the effective parameters. The determination of thermal errors caused by additional radiation of surfaces having temperatures different form those of the shroud, are described. Two different methods are presented: one experiment with a black sphere and one with a black plate. The evaluated results are compared and discussed. Author (ESRO)

N74-15572# Calspan Corp., Buffalo, N.Y.
TRANSONIC WIND TUNNEL TESTS ON A MISSILE MODEL WITH CANARD WINGS, VOLUME 1
R. E. DeKuyper. Jul. 1973 671 p refs
(Contract DAAH03-73-C-0243)
(AD-767282; CALSPAN-AA-4017-W-9-Vol-1) Avail: NTIS CSCL 16/4

Transonic wind tunnel tests were performed in an Calspan Corporation (formerly Cornell Aeronautical Laboratory) Eight-Foot Transonic Wind Tunnel on a missile model with canard wings. The tests were conducted during the end of April and the beginning of May, 1973. Two distinctly different investigations were made. The effect of canard wing positions, canard tail angular orientation, canard size, model roll angle, and nose shape, were investigated during the Aerodynamic Test Phase. The use of canard wings for roll attitude control was also investigated during this phase. The effect of different jet plumes on the aerodynamic model loads were studied during the Thrust Effect Phase. A normal jet plume simulator was used and the effects of model tail position, planform, and orientation were investigated. The report presents details of the test program and the results in tabular form. GRA

N74-15573# Naval Ordnance Lab., White Oak, Md.
AXISYMMETRIC ELLIPSOIDS IN IDEAL FLUIDS
Charles W. Smith and John R. Guala, Jr. 1 Aug. 1973 22 p refs
(AD-768302; NOLTR-73-155) Avail: NTIS CSCL 16/4

The report, the pressure acting on an axisymmetric ellipsoid in general motion is obtained. The forces and moments on the ellipsoid are then calculated. The behavior of the pressure, forces, and moments is then examined as the ellipsoid becomes slender. Author (GRA)

N74-15574# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ONE OPERATING PRINCIPLE OF A MANNED ORBITAL ASTRONOMICAL OBSERVATORY
G. A. Gurzadyan. 16 Oct. 1973 9 p Transl. into ENGLISH from Byurakanskaya Observ. Soobshcheniya (USSR), no. 65, 1972 p 5-11
(AD-769049; FTD-HT-23-195-74) Avail: NTIS CSCL 22/2

The development of manned spaceships and orbital stations has presented new possibilities for carrying out astrophysical observations under extra-atmospheric conditions. Primarily, such stations can contain larger telescopes and other astronomical equipment. Secondarily, the presence of a cosmonaut aboard the orbital station, even one who is not a professional astronomer, makes it possible to provide a broader and more complex observation program than when the observatory is completely automatically controlled by systems having a specific preset program, one not subject to change. GRA

N74-15613 Grumman Aerospace Corp., Bethpage, N.Y. Structural Mechanics Section.
APPLICATION OF A DESIGN ANALYSIS SYSTEM TO A SPACE SHUTTLE PRELIMINARY DESIGN
W. Lansing, P. Mason, W. Dwyer, and J. C. Cooper *In* AGARD Second Symp. on Structural Optimization Nov. 1973 14 p refs (For availability see N74-15596 06-32)

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N74-15575 British Library Lending Div., Boston Spa (England).
CREEP STENGTH OF METALLIC MATERIALS: CREEP RUPTURE WITH TIME-VARYING TEMPERATURE
5 Jul. 1973 7 p refs Transl. into ENGLISH from the publ. "Kriechfestigkeit metallischer Werkstoffe" Odgvist-Hult p 224-227
(BLL-Risley-TR-2697-(9091.9F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

The general principles of the creep mechanism for metallic materials are presented. Strain and deformation with stationary creep are analyzed to show the application to bending of straight rods, bending of curved rods, bending of level beams, and shells. The strain and deformation conditions existing with unstationary creep are described for the following: (1) physical primary creep, (2) static primary creep, (3) time-varying stress, (4) stress relief, and (5) thermal stresses. Stability problems associated with creep are examined. Numerical analysis by the application of Cartesian tensors is demonstrated. Author

N74-15576 British Library Lending Div., Boston Spa (England).
FATIGUE LIFE OF STRUCTURAL COMPONENTS UNDER RANDOM LOADING
E. Gassner 3 Sep. 1973 34 p refs Transl. into ENGLISH from Material Pruefung (Duesseldorf), v. 15, no. 6, 1973 p 197-205 In ENGLISH and GERMAN
(BLL-NEL-TT-2504-(6075.461)) Avail: British Library Lending Div., Boston Spa, Engl.: 4 BLL photocopy coupons

An approach is presented to the solution of problems involving the prediction of fatigue life of structures subjected to random loads. It is aimed at developing a standard procedure based on the relevant literature. D.L.G.

N74-15577 Engineering Sciences Data Unit, London (England).
GUIDE TO ITEMS ON STRUTS, BEAMS AND SHAFTS
Jun. 1973 15 p refs
(ESDU-SS3-Amend-A) Copyright. Avail: Issuing Activity

A guide on the effects of buckling and deflections of idealized struts, beams and shafts is presented. Factors of safety, and allowable stresses are also discussed. F.O.S.

N74-15578 Engineering Sciences Data Unit, London (England).
GUIDE TO THE USE OF THE STRESS AND STRENGTH SUB-SERIES
Apr. 1973 21 p
(SS-1) Copyright. Avail: Issuing Activity

A data retrieval system for obtaining information on the stress and strength parameters of materials is described. The data items are arranged in subject groups and each group is preceded by a guide card giving the group title. Within each group the data items are in numerical order. Each guide card carries a list of the other group titles and the volume in which they may be found. The subjects presented include the following: (1) failure under a single application of load, (2) fatigue failure, (3) brittle fracture, (4) stress corrosion cracking, (5) creep rupture, (6) deformations, and (7) allowable stresses and safety factors. Author

N74-15579 Engineering Sciences Data Unit, London (England).
CRITERIA OF YIELDING FOR DUCTILE MATERIALS UNDER STATIC LOADING
Jul. 1973 9 p ref Sponsored by Inst. of Mech. Engr.
(ESDU-73004) Copyright. Avail: Issuing Activity

The procedure for determining the yield strength of ductile materials under static load is presented. The nature of the yield stress is defined. The complexity of stresses found in engineering components makes it necessary to predict the point of yielding under multiaxial stress from a knowledge of the material yield stress provided by the simple uniaxial tensile tests. A synopsis of the criteria for two and three dimensional principal stresses is developed. Author

N74-15580 Engineering Sciences Data Unit, London (England).
FATIGUE OF STEEL SPLINE ASSEMBLIES UNDER REVERSED TORSION
Jun. 1973 11 p Sponsored by the Inst. of Mech. Engr.
(ESDU-73002) Copyright. Avail: Issuing Activity

Data on the fatigue strength of steel splines under reversed torsion applied by the female member, the shaft being free from bending or axial loading, are presented. Data on male splines are provided together with data on the effects of the number of splines, the shape, and surface condition. All the fatigue failures initiated at one or more of the roots of the splines of the male member at the point where it entered the female member. The crack, or cracks, then grew on a helical path until rupture occurred. No failures or significant damage to the female splines occurred. Author

N74-15581 Lehigh Univ., Bethlehem, Pa.
AN APPROXIMATE THREE DIMENSIONAL THEORY OF LAYERED PLATES CONTAINING THROUGH THICKNESS CRACKS Ph.D. Thesis
Robert Badaliance 1973 84 p
Avail: Univ. Microfilms Order No. 73-23786

The theory is developed by assuming an approximate form for the stress field as a product of a function of the out-of-plane variable multiplied by a function of the in-plane variables. The variational principle of minimum complementary potential energy is employed to obtain a system of partial differential equations and associated boundary conditions which govern the in-plane variation of the stress field. This approximate theory is then applied to the problem of a laminar composite plate containing a through-the-thickness crack subjected to in-plane loading normal to the crack face. The resulting mixed boundary value problem is solved by integral transform methods. The stress field in the vicinity of the crack edge is obtained in closed form demonstrating qualitative features characteristic of the exact three-dimensional asymptotic solution. The through-the-thickness variation of this stress field is chosen so as to enforce plane strain conditions within each layer of the composite plate. Dissert. Abstr.

N74-15582 Michigan Univ., Ann Arbor.
THE EFFECT ON CONTROLLED INTERMITTENT INTERFACIAL BONDING ON THE TENSILE PROPERTIES AND FRACTURE TOUGHNESS OF A BORON-EPOXY COMPOSITE Ph.D. Thesis
Theodore Utley Marston 1973 201 p
Avail: Univ. Microfilms Order No. 73-24632

The concept of an intermittent interfacial bond is introduced as a means for improving the longitudinal tensile properties and fracture toughness of a composite material without reducing properties in the transverse direction. The boron-epoxy composite system was used as the experimental system. Tensile specimens with low volume fraction filament were produced with uncoated, coated, and intermittently coated boron filaments. A suitable coating material was selected and the appropriate apparatus was designed. The fracture strain (&f) was used as the merit index for the effect of intermittency of coatings. Intermittently coated filaments within the range thirty-eight to seventy-two percent coated consistently increased the fracture strain by 35% over that of the uncoated filaments. There was little variation among the fracture strains of all intermittently coated samples. Scanning electron fractography was used to aid the analysis of the fracture sequence and the local effects of coating. Dissert. Abstr.

N74-15583 Engineering Sciences Data Unit, London (England).
DESIGN FOR MINIMUM STRUTS OF UNIFORM SECTION THIN-WALLED SQUARE TUBES
Apr. 1966 7 p refs
(ESDU-66006) Copyright. Avail: Issuing Activity

The cross-sectional dimensions for minimum weight of thin-walled struts of uniform square section and given length are described. Information is also presented on the weight penalty incurred by restricting either of the cross-sectional dimensions. No allowance is made for the eccentricity or overall curvature of the strut. A mathematical example is provided to demonstrate a typical analysis. Author

N74-15584 Engineering Sciences Data Unit, London (England).
DESIGN FOR MINIMUM WEIGHT STRUTS OF UNIFORM SECTION. 1: SECTIONS
Apr. 1966 10 p refs Sponsored by Roy. Aeron. Soc.
(ESDU-66007) Copyright. Avail: Issuing Activity

The cross sectional dimensions for minimum weight of struts of uniform I-section and given length are reported. The weight penalty incurred by restricting any one of the cross-sectional dimensions is analyzed. The numerical procedures for solving the design problem are presented for several cases. The buckling modes for structs with various cross sections are presented in graph form. Author

N74-15585 Engineering Sciences Data Unit, London (England).
DESIGN FOR MINIMUM WEIGHT STRUTS OF UNIFORM SECTION THIN-LOADED CIRCULAR TUBES
Apr. 1966 7 p refs Sponsored by Roy. Aeron. Soc.
(ESDU-66005) Copyright. Avail: Issuing Activity

The cross-sectional dimensions for minimum weight of thin-walled struts of uniform circular section and given length are presented. The weight penalty incurred by restricting either of the cross-sectional dimensions is reported. To determine the dimensions of a strut of least weight, the material is assumed to be perfectly elastic. Examples of the numerical solution of the design problem are developed. Author

N74-15586 Engineering Sciences Data Unit, London (England).
BUCKLING LOADS UNDER COMBINED LONGITUDINAL AND TRANSVERSE DIRECT STRESS OF FLAT SANDWICH PANNELS. ISOTROPIC FACE PLATES AND CORRUGATED CORES, ALL EDGES SIMPLY-SUPPORTED
Jun. 1967 17 p ref Supersedes ESDU-Struct-07.01.02
(ESDU-67032; ESDU-Struct-07.01.02) Copyright. Avail: Issuing Activity

A numerical procedure for analyzing the buckling loads under combined longitudinal and transverse direct stress of flat sandwich panels is presented. It is assumed that the face plates are isotropic with corrugated cores. All edges are simply supported. Tables of data are included to show the mechanical properties for specimens with different dimensions. Author

N74-15587 Engineering Sciences Data Unit, London (England).
MODULUS OF RIGIDITY OF SANDWICH PANELS WITH HEXAGONAL CELL CORES
Mar. 1967 2 p refs Sponsored by Roy. Aeron. Soc.
(ESDU-67022) Copyright. Avail: Issuing Activity

A procedure for calculating the modulus of rigidity of sandwich panels with hexagonal cell cores is presented. The data are based on the assumption that no out-of-plane bending of the face plates occurs. Mathematical models used for making the analysis are developed. Data are presented in graph form for structures of various dimensions. Author

N74-15588 Engineering Sciences Data Unit, London (England).
DESIGN FOR MINIMUM WEIGHT STRUTS OF UNIFORM SECTION: MINIMUM WEIGHTS FOR VARIOUS SECTIONS
May 1966 3 p Sponsored by Roy. Aeron. Soc.
(ESDU-66008) Copyright. Avail: Issuing Activity

A procedure for designing struts of uniform section with minimum weight is developed. The struts are assumed to be of elastic materials with thin walled, circular, square, and i-section configurations. An example of the numerical analysis of a square tubular strut with one end fixed and the other free is presented. Data are presented for tubes of three different cross sections in graph form. Author

N74-15589 Engineering Sciences Data Unit, London (England).
EXPERIMENTAL DETERMINATION OF THE SHEAR AND FLEXURAL STIFFNESSES OF A SANDWICH PANEL
Jun. 1967 2 p refs Sponsored by Roy. Aeron. Soc.
(ESDU-66025) Copyright. Avail: Issuing Activity

An experimental method for determining the shear and flexural stiffness of a sandwich panel is presented. The method tests a specimen strip of sandwich structure as a simply supported beam under a five point loading. The deflection due to shear and the deflection due to bending are determined, thus allowing the shear and bending stiffness of the sandwich to be evaluated. An example of the procedure followed for a typical case is furnished. Author

N74-15590 Engineering Sciences Data Unit, London (England).
BUCKLING LOADS IN SHEAR OF FLAT SANDWICH PANELS. ISOTROPIC FACE PLATES AND CORRUGATED CORES, ALL EDGES SIMPLY SUPPORTED
Jun. 1967 4 p ref Sponsored by Roy. Aeron. Soc.
(ESDU-67026) Copyright. Avail: Issuing Activity

An analysis of the effects of buckling loads in shear on flat sandwich panels is presented. It is assumed that during buckling the face plates remain a constant distance apart. The shear stiffness ratio is considered to be infinite. The data are presented in the form of curves which are applicable to simply-supported sandwich panels having isotropic face plates and corrugated cores, stressed in the elastic range. Author

N74-15591 Engineering Sciences Data Unit, London (England).
INFORMATION ON THE USE OF ITEM NO. 73007
Sep. 1973 2 p refs
(ESDU-02.01.28-Amend-A-Amend-B) Copyright. Avail: Issuing Activity

The application of data on stiffness of loaded flat strips under sinusoidally distributed bending couples at their edges to the stimulation of local buckling stress of stiffened panels is described. The data relate to thin strips of isotropic or orthotropic material under the action of a stress acting along the strip with, or without, a direct stress acting across the strip. The data are applicable to modes of deformation which involve distortion but not translation of the cross section. Author

N74-15592 Engineering Sciences Data Unit, London (England).
INTER-RIVET BUCKLING CURVES FOR SPECIFIC MATERIALS
Apr. 1973 3 p
(ESDU-02.01.09-Amend-A) Copyright. Avail: Issuing Activity

Example curves are presented for fixity coefficients of snap head rivets for three commonly used aluminum alloys. Author

N74-15593 Virginia Polytechnic Inst. and State Univ., Blacksburg.
COMPRESSIVE STRENGTH OF LAMINA REINFORCED AND FIBER REINFORCED COMPOSITE MATERIALS Ph.D. Thesis
John Grady Davis, Jr. 1973 247 p
Avail: Univ. Microfilms Order No. 73-26264

Results are presented from a theoretical and experimental investigation on the compressive strength of lamina reinforced and fiber reinforced composite materials when loaded parallel to the reinforcement. An analytical model was proposed which replaces the fiber reinforced composite with a laminate containing initially curved laminae. By applying the Timoshenko beam equations to each layer of the laminate, an interlaminar shear stress analysis was developed which can be used to predict the behavior of the laminate under compressive loading. Two modes

of failure are considered in the analysis, delamination and shear instability, and nonlinear shear stress-strain behavior of the laminae is included. Axial compression tests were performed on aluminum-wax laminates, boron-epoxy tubes, and S-glass-epoxy tubes. In addition, torsion tests and combined compression and torsion tests were conducted on the fiber reinforced tubes. Adequate correlation between theory and experiment was obtained for both lamina and fiber reinforced test results. Dissert. Abstr.

N74-15594# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
NOTCH SENSITIVITY AND FATIGUE STRENGTH OF AIRCRAFT SHEET MATERIAL SPECIMENS
Alfred Buch [1973] 39 p refs
(TAE-184) Avail: NTIS HC $4.00

Fatigue tests were performed in tension-compression and pulsating tension on internally notched sheet specimens, K sub T = 2 to 4.6, for comparison of the notch factor K sub F and notch sensitivity index, K sub E/K sub T, for sheet materials 6061-T4, 2024-T3, and 7075-T6 with and without cladding. The fatigue limits of unnotched and notched specimens were higher for bar specimens 7075-T6 and 2024-T3 compared with corresponding Alclad specimens. The fatigue limit values of 6061-T4 were similare to the corresponding values for 2024-T3-Alclad. For all investigated materials increased the ratios K sub F/K sub T with the notch radius r. This permitted an analytical and graphical formulation of the notch sensitivity functions K sub F/K sub T = f(r) for the investigated Al-alloys; with aid of a two-parameter formula. Author

N74-15595# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
MATERIAL DAMPING AND ITS ROLE IN LINEAR DYNAMIC EQUATIONS
W. B. Graham Mar. 1973 112 p refs Sponsored by Commun. Res. Center
(UTIAS-36) Avail: NTIS HC $7.75

A short historical survey of material damping is presented along with a discussion of the elementary ideas and properties of elastic solids. Definitions, notation and classifications commonly used in damping studies are presented. In addition, some of the mechanisms in damping are related in brief detail to provide a sense of the physical sources of damping. The phenomenological approach to damping is discussed in terms of general linear viscoelasticity. Models for certain anelastic behaviour are also included. The simple techniques which were used most often in engineering dynamics to describe damping properties are criticized, and a few of the arguments which support or deny their substance are noted. More emphasis, however, is given to those phenomenological models which can be formed within the confines of general linear viscoelasticity. Finally, a model is suggested for linear damping, which makes use of the creep or stress-relaxation functions. Author

N74-15596# Advisory Group for Aerospace Research and Development, Paris (France).
SECOND SYMPOSIUM ON STRUCTURAL OPTIMIZATION
Nov. 1973 390 p refs Struct. and Mater. Panel Symp. held at Milan, 2-4 Apr. 1973
(AGARD-CP-123) Avail: NTIS HC $21.50

The symposium papers are presented with the major emphasis placed on methods which are already in, or are rapidly nearing, a practical operational status. The papers demonstrate a remarkable diversity of practical applications of the various approaches to structural optimization. For individual titles, see N74-15597 through N74-15617.

N74-15597 Brown Univ., Providence, R.I.
NECESSARY AND SUFFICIENT CONDITIONS FOR GLOBAL STRUCTURAL OPTIMALITY
W. Prager *In* AGARD Second Symp. on Structural Optimization Nov. 1973 12 p refs Sponsored by AROD (For availability see N74-15596 06-32)

A method is discussed by which necessary and sufficient conditions for global structural optimality can be derived for a wide variety of design constraints. The importance is stressed of conditions that are not only necessary but also sufficient for global optimality. To present the method, minimum-mass design of a truss with prescribed elastic compliance is treated when the truss is to be derived from a given basic layout, and when the layout is left open. Use of the method for other constraints, alternative states of loading, and structures of other types is illustrated by examples. Computational aspects of structural optimization are discussed. Author

N74-15598 Bell Aerospace Co., Buffalo, N.Y. Structural Systems Dept.
SURVEY OF THE STATE-OF-THE-ART OF OPTIMIZATION TECHNOLOGY WITHIN NATO COUNTRIES
Ronald A. Gellatly *In* AGARD Second Symp. on Structural Optimization Nov. 1973 20 p refs (For availability see N74-15596 06-32)

The Working Group on Optimization of the Structures and Materials Panel, AGARD, as part of its continuing activity sponsored a survey of the state-of-the-art in structural optimization and automated design technology within NATO countries. The results of meetings held with representatives of Italy, Germany, Holland, Belgium, France, and Great Britain are presented along with submittals from Denmark, Norway, Canada and Portugal. A brief survey of the state-of-the-art in the United States is also included. Author

N74-15599 Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio. Synthesis Group.
APPLICATION OF OPTIMALITY CRITERIA APPROACHES TO AUTOMATED DESIGN OF LARGE PRACTICAL STRUCTURES
V. B. Venkayya, N. S. Khot, and L. Berke *In* AGARD Second Symp. on Structural Optimization Nov. 1973 19 p refs (For availability see N74-15596 06-32)

A unified approach for the derivation of optimality criteria for the design of optimum structures is presented. The design conditions included requirements of generalized stiffness, specified displacements, dynamic stiffness and stiffness for general stability. Recursion relations for achieving the optimality criteria are derived for all these cases. Both single and multiple stiffness requirements are considered. The formulation considers isotropic, anisotropic and layered composite structures. Four categories of design examples are selected to illustrate the versatility of the method. The first group is designed for static loads with constraints on stresses, displacements and minimum sizes. The second group of examples is designed for dynamic loads with periodic time dependence. The third group consists of layered composite structures subjected to static loads. The fourth group is concerned with static stability requirements. The results of many of these examples are compared with those available in the literature. Author

N74-15600 Case Western Reserve Univ., Cleveland, Ohio.
RECENT DEVELOPMENTS IN THE CASE OPTIMIZATION PROGRAM
Fred Moses *In* AGARD Second Symp. on Structural Optimization Nov. 1973 8 p refs (For availability see N74-15596 06-32)

Three optimization problem types and respective solutions are identified. A penalty function approach is used for design of elements such as welded girders, columns, prestressed concrete beams and simple gabled frames which have complex design code constraints but relatively few design variables. The second problem type includes a modified Zoutendijk feasible direction method and has been used for structural system constraints such as deflection, stability and flutter. The third problem type includes discrete variables involving sizes, inventory and fabrication costs and can often be handled by dynamic programming. The influence of optimum design on safety and reliability remains a continuing area of research and models of reliability analysis and design are discussed. Author

N74-15601 Liverpool Univ. (England). Dept. of Civil Engineering.
STRUCTURAL DESIGN APPLICATIONS OF GEOMETRIC PROGRAMMING
A. B. Templeman and S. K. Winterbottom *In* AGARD Second Symp. on Structural Optimization Nov. 1973 16 p refs (For availability see N74-15596 06-32)

The technique of geometric programming is described for the solution of non-linear optimization problems. The form in

which the method was first developed, now usually known as prototype geometric programming, is presented in some detail and this is followed by a description of more recent developments which have considerably extended the scope and usefulness of the method. It is demonstrated that many problems arising in optimum structural design may be formulated in such a way as to be easily and rapidly solved using geometric programming. Finally the problem of designing minimum weight space trusses to satisfy stress and deflection constraints is examined and it is shown that by using a further-extended approximate form of geometric programming optimum designs may be derived iteratively using only a few cycles of analysis and iteration.
Author

N74-15602 Royal Aircraft Establishment, Farnborough (England). Structures Dept.
THE OPTIMISATION OF STATICALLY INDETERMINATE STRUCTURES BY MEANS OF APPROXIMATE GEOMETRIC PROGRAMMING
A. J. Morris *In* AGARD Second Symp. on Structural Optimization Nov. 1973 17 p refs (For availability see N74-15596 06-32)

Application of approximate geometric programming in the least weight design of statically indeterminate structures is described. It is shown how the facility of standard geometric programming to obtain bounds on a minimum weight design is preserved. The advantages of coupling geometric programming with a modern projected gradient method are also described. Numerical examples which are used to illustrate the method involve up to two load conditions with active constraints on stresses and displacements.
Author

N74-15603 Middle East Technical Univ., Ankara (Turkey).
APPLICATION OF DISCRIMINATE FUNCTION TECHNIQUE TO RANDOM SEARCH
M. O. Kiciman and M. Akguel *In* AGARD Second Symp. on Structural Optimization Nov. 1973 10 p refs (For availability see N74-15596 06-32)

Statistical methods of discrimination were used as a decision making tool in nonlinear, constrained, optimization problems. A linear discriminant function form is proposed as an aid to the preliminary designer. It is assumed that a design problem with a large number of variables is given, and only an approximate answer that will aid the decision maker is required. The possibility is discussed of representing each design point in a reduced design space by means of pooling the variables. The optimization procedure based on a combination of direct search and discriminant function method was applied to typical test problems and to a grid-design problem. The grid has a stiffness dependent loading condition, with merit function not directly dependent on some of the design variables. This particular choice was made in order to illustrate the complete generality of the method.
Author

N74-15604 Istituto di Elaborazione dell'Informazione, Pisa (Italy).
INTEGER PROGRAMMING ALGORITHMS FOR OPTIMUM STRUCTURAL DESIGN
Aldo Cella *In* AGARD Second Symp. on Structural Optimization Nov. 1973 14 p refs (For availability see N74-15596 06-32)

A large variety of structural design problems is constrained by the practical necessity of selecting the design parameters from an enumerable set of discrete values. The resulting solution space has a grid-like pattern, and an enumerative, combinatorial algorithm seems most appropriate for the problem. A branch-and-bound algorithm was developed for the optimal design of a large class of lineary elastic structures, discretized into finite elements, and subjected to stress, deflection and stiffness constraints. Sensitivity coefficients were developed for all those constraints. The algorithm is of the enumerative kind, having decision rules that are specific to the solution space associated with structural problems. The resulting numerical procedure was applied to the optimal design of a number of aerospace type structures, such as the hammerhead of a large scale radiotelescope, and the supporting structure of an orbiting telescope mirror.
Author

N74-15605 Politecnico di Milano (Italy).
SHAPE OPTIMIZATION USING MATHEMATICAL PROGRAMMING AND MODELLING TECHNIQUES
Edmondo Vitiello *In* AGARD Second Symp. on Structural Optimization on Nov. 1973 11 p refs (For availability see N74-15596 06-32)

Structural optimization of elastic models with design variables describing their geometry is considered. The use of mathematical programming for practical design is shown in connection with a progressive (quadratic) fitting of the constraints in the space of design variables (modelling). The method proves successful for a few design variables and for smooth variations of stresses and loads with the design variables. However it seems to make feasible the use of optimization for practical design in some fields where earlier optimization methods implied very heavy calculations. Applications to the optimum design of gravity dams, considering both their static (finite element analysis) and dynamic (seismic) behavior, is presented.
Author

N74-15606 Cranfield Inst. of Technology (England). Coll. of Aeronautics.
THE DESIGN OF COMPATIBLE STRUCTURES
D. M. Richards *In* AGARD Second Symp. on Structural Optimization Nov. 1973 13 p refs (For availability see N74-15596 06-32)

A format for the economical description of complex structures for design purposes is introduced. Sufficient conditions under which a redundant configuration may be fully stressed are formulated. These conditions are used to determine a wide range of simple frameworks with this property. Some characteristics of sequential redesign trajectories are described, utilizing the format.
Author

N74-15607 Cornell Univ., Ithaca, N.Y. Dept. of Structural Engineering.
OPTIMIZATION OF STIFFENED PANELS
R. H. Gallagher and W. E. Falby *In* AGARD Second Symp. on Structural Optimization Nov. 1973 14 p refs (For availability see N74-15596 06-32)

A program is described for the structural optimization of longitudinally stiffened plates loaded in compression. The complexity of the problem is reduced significantly by exploiting the understanding of the initial buckling and postbuckling behavior of these panels in order to reduce the number of inequality constraint conditions. An interior penalty function technique is combined with an unconstrained optimization algorithm to produce an efficient optimization program. Results generated by the program are compared with relevant data from design charts.
Author

N74-15608 Technical Univ. of Denmark, Lyngby. Dept. of Solid Mechanics.
OPTIMAL JOINT POSITIONS FOR SPACE TRUSSES
Pauli Pedersen *In* AGARD Second Symp. on Structural Optimization Nov. 1973 14 p ref (For availability see N74-15596 06-32)

An iterative procedure is presented for determining the joint positions corresponding to a minimum mass space truss. Displacement constraints and non-constant stress constraints (stability) are taken into account. The truss is presumed to carry consecutively a large number of different systems of forces. The iteration includes a sequence of linear programming problems (SLP, with move-limits), and for each of these problems only the nearby constraints are considered. Analytical expressions are given for the gradients describing the linear problems.
Author

N74-15609 Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
APPLICATION OF A GENERAL METHOD FOR FLUTTER OPTIMIZATION
R. F. Taylor (AFFDL) and L. B. Gwin *In* AGARD Second Symp. on Structural Optimization Nov. 1973 14 p refs (For availability see N74-15596 06-32)
(Contracts F33615-70-C-1282; F33615-72-C-1275)

Design of modern aircraft requires that aeroelastic considerations be included as early as possible to avoid addition of excessive weight for prevention of aeroelastic instabilities. A computational approach for minimum weight design of flutter critical lifting surfaces is presented which has generality in the selection of analysis methods and demonstrated applicability to problems

involving a large number of design variables. A key feature of the method is the calculation of derivatives of the flutter speed with respect to design parameters. These analytically derived derivatives are computed in such a way that they are economical for large scale problems. The mathematical programming method which utilizes these derivatives is based on the method of feasible directions with a simplex algorithm to solve a linearized direction-finding problem. Results are presented which show that the method can efficiently reduce the structural weight of lifting surface designs involving at least 99 design variables. Author

N74-15610 Bell Aerospace Co., Buffalo, N.Y. Structural Systems Dept.
MINIMUM WEIGHT DESIGN OF SURFACE EFFECT VEHICLES USING THE SIEVE-SEARCH TECHNIQUE
James R. Batt and Ronald A. Gellatly *In* AGARD Second Symp. on Structural Optimization Nov. 1973 14 p refs (For availability see N74-15596 06-32)
(Contract MA-4687)

Past and present methods for the optimization of structural systems for minimum weight use mathematical programming or numerical search techniques. This procedure has lead to an intractable situation whereby large computer costs and mathematical complexity arisesj More economical and more flexible procedures for structural optimization of large scale systems have therefore been sought. A new approach to determine the minimum weight of such systems has been developed and is labeled the 'sieve-search' technique. In performance of optimization studies using this technique, the guiding philosophy was to generate an optimal arrangement of preoptimized components. An essential element of the technique is the use of data banks which contain minimum weight and associated geometry of the structural components. These banks are generated using classical methods of optimization. An additional facet of the technique is the use of simplified engineering analysis methods during the redesign phase of the optimization cycle. Author

N74-15611* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AUTOMATED SIZING OF LARGE STRUCTURES BY MIXED OPTIMIZATION METHODS
Jaroslaw Sobieszczanski and David Loendorf (Army Air Mobility R. and D. Lab.) *In* AGARD Second Symp. on Structural Optimization Nov. 1973 12 p refs (For availability see N74-15596 06-32)

A procedure for automating the sizing of wing-fuselage airframes was developed and implemented in the form of an operational program. The program combines fully stressed design to determine an overall material distribution with mass-strength and mathematical programming methods to design structural details accounting for realistic design constraints. The practicality and efficiency of the procedure is demonstrated for transport aircraft configurations. The methodology is sufficiently general to be applicable to other large and complex structures. Author

N74-15612 British Aircraft Corp., Preston (England). Military Aircraft Div.
OPTIMISATION OF AIRCRAFT STRUCTURES WITH MULTIPLE STIFFNESS REQUIREMENTS c02
I. C. Taig and R. I. Kerr *In* AGARD Second Symp. on Structural Optimization Nov. 1973 14 p refs (For availability see N74-15596 06-32)

A general optimality theorem is presented for structures whose members have stiffnesses proportional to their masses and which are designed by generalized stiffness requirements. The theorem is used to derive an iterative procedure for optimum structure design. Modifications to the basic theorem enable practical constraints such as minimum material gauges and strength or stability requirements to be introduced. The method can be used where stiffness requirements are directly specified for given loading conditions or where vibration frequency or aeroelastic efficiency requirements are stipulated. A useful feature of the method, when used in conjunction with automated design procedures, is that the optimization can operate with real structure variables and constraints so that there is no subsequent design operation required to convert idealised structure dimensions to feasible detail sizes. Several examples are quoted to show that very favorable results and computing times are obtainable for demonstration problems. The ability to handle major structural optimization is also illustrated by applications to actual airframe structures. Author

N74-15613 Grumman Aerospace Corp., Bethpage, N.Y. Structural Mechanics Section.
APPLICATION OF A DESIGN ANALYSIS SYSTEM TO A SPACE SHUTTLE PRELIMINARY DESIGN c31
W. Lansing, P. Mason, W. Dwyer, and J. C. Cooper *In* AGARD Second Symp. on Structural Optimization Nov. 1973 14 p refs (For availability see N74-15596 06-32)

In a broad sense, interdisciplinary design analysis systems are optimization tools, of which the specialized computer programs which resize structures of fixed topology are merely a part. This interrelationship is portrayed by describing briefly the Integrated Design Analysis System (IDEAS) and showing how its Automated Structural Optimization Program (ASOP) is incorporated within the basic system. Application to a preliminary design of the space shuttle is presented and ways in which ASOP is being improved are discussed. Author

N74-15614 Messerschmitt-Boelkow-Blohm G.m.b.H., Hamburg (West Germany). Stress Dept.
OPTIMIZATION AND DESIGN OF THE REAR FUSELAGE OF THE A 300 B AIRCRAFT STRUCTURE c02
D. Schulz *In* AGARD Second Symp. on Structural Optimization Nov. 1973 15 p refs (For availability see N74-15596 06-32)

A method is described for the automatically controlled calculation of a skin/stringer structure. The method was programmed and applied for the first time for the development of the Airbus A 300 B. The method can be considered as a link in a process chain, the target of which is the overall development of aircraft structures. It starts with the calculation of statically indeterminate forces and ends up with the statical strength analysis. Input and output data for the calculations of statically indeterminate forces are used as input data for structure dimensioning or strength analysis program. The structure dimensioning program iteratively modifies the originally defined wall thicknesses so that the reserve factors required to prevent failure under tensile, compression and shear loads are reached or only slightly exceeded in all critical load cases. The originally defined structural concept (stringer and frame spacing as well as stringer shapes) is not changed in this case. Final dimensioning is influenced by manufacturing considerations. On completion of the dimensioning work the dimensions are laid down and the strength analysis is carried out in a single computer run. The flow of the program is demonstrated in the example of the Airbus A 300 B rear fuselage. Author

N74-15615 Chantiers de l'Atlantique Saint-Nazaire (France).
THE DOUBLE ITERATION METHOD IN STRUCTURAL OPTIMIZATION c19
Daniel H. Finifter *In* AGARD Second Symp. on Structural Optimization Nov. 1973 10 p refs (For availability see N74-15596 06-32)

Most structural optimization processes require a large number of iterations to be performed, involving at each step a detailed stress analysis of the current design. Considering that a gross analysis is comparatively very economical, it is possible to perform most iterations on a simplified mesh, with only occasional refined analyses to correct the mismodeling effects. Although the overall number of steps, referred to as primary iterations, necessary to achieve the optimum is then higher than by conventional procedures, only those involving a detailed analysis, or secondary iterations, are significant timewise. That double iteration scheme was employed in determining the minimum weight design, assumed to be fully-stressed, of a tanker web frame, using the stress-ratio method. Satisfactory convergence was reached after 2 secondary iterations, whereas by standard calculations 8 to 10 would have normally been required. Author

N74-15616 Technische Hochschule, Aachen (West Germany). Inst. fuer Leichtbau.
HOMOLOGOUS DEFORMATION OF STIFFENED SHELLS FOR RADIO TELESCOPE STRUCTURES c14
J. F. Kowalewski and H. A. Ziebarth *In* AGARD Second Symp. on Structural Optimization Nov. 1973 13 p refs (For availability see N74-15596 06-32)

In radio telescopes all surface elements have to reflect incoming radio-waves to a defined focus, i. e. the surface should be an exact paraboloid. As a telescope has to be tilted elastic deformations caused by rotating the telescope about a horizontal axis are invitable. But these deformations should be homologous, i. e. should change only the position of the focus, the focal length and the axis of the paraboloid. The report deals with the homology conditions for the displacements and the rotations of the tangents of the surface and the change of the parameters of the paraboloid. It is shown how to find the optimum design of a reflector shell, which complies with these homology conditions. Author

N74-15617 Technische Univ., Berlin (West Germany). Inst. of Aeronautics and Astronautics.
OPTIMIZATION OF THE LAYOUT OF TRUSSES COMBINING STRATEGIES BASED ON MICHELL'S THEOREM AND ON THE BIOLOGICAL PRINCIPLES OF EVOLUTION
A. Hoefler, U. Leysser, and J. Wiedeman *In* AGARD Second Symp. on Structural Optimization Nov. 1973 8 p refs (For availability see N74-15596 06-32)

A method developed for finding the optimum layout of plane trusses is reviewed. Both strategies employed are described in some detail, giving special attention to the problem of selecting the proper set of points at the beginning of the optimization process. An example of the application of the evolution strategy is given. When both strategies are combined, having each one perform the function in the optimization process it is best suited for, their specific disadvantages can be eliminated. Thus an initial design is found using linear programming while the evolution strategy is used to find better positions of the joints. This constitutes one cycle of optimization. More cycles will follow if the improved positions of the joints require a change in the set of the optimum bars. The problem of a cantilever truss loaded at the tip is solved using the combined strategies. The optimum structure for this case being known, a comparison is made showing the efficiency of the method. Author

N74-15618# National Aeronautical Lab., Bangalore (India).
CALCULATION OF BUCKLING AND RESIDUAL STRESSES IN THE CASE OF NON-SYMMETRIC HEATING AND COOLING
G. Z. Serebrennikov [1972] 14 p refs Transl. into ENGLISH from Aviats. Tekh. (Kazan,), v. 13, no. 3, 1970 p 152-156
(NAL-TR-96) Avail: NTIS HC $3.00

The nonsymmetrical heating and cooling of plates and bars of rectangular section are considered. Nonlinear nonsymmetrical components in the temperature field equation are taken into account. Author

N74-15619# National Aeronautical Lab., Bangalore (India).
OPTICAL POLARIZATION METHOD OF STUDYING THE STRESS STATE OF ANISOTROPIC BODIES
V. P. Netrebko Jan. 1972 21 p refs Transl. into ENGLISH from Mekh. Tverdogo Tela (USSR), no. 1, 1971 p 94-100
(NAL-TR-102) Avail: NTIS HC $3.25

An optical polarization method is used for investigating the stressed state of plane orthotropic bodies on models of structural anisotropic materials. Example solutions for an anisotropic polymer plate fabricated from epoxy resins and woven fiber glass are presented. G.G.

N74-15620# National Aeronautical Lab., Bangalore (India).
A CASE OF THERMAL STRESS CONCENTRATION
M. M. Sidlyar Apr. 1971 14 p refs Transl. into ENGLISH from An Ukr. SSR, Inst. Mekhan., Teplovye Napryazh. v Elementakh Konstruktsii (USSR), no. 9, 1970 p 70-78
(NAL-TR-94) Avail: NTIS HC $3.00

The theory of Bessel functions and Fourier series methods are used to determine thermal stress concentration in a cylindrical cavity. G.G.

N74-15621# National Aeronautical Lab., Bangalore (India).
TORSION OF A CONICAL SHELL, WEAKENED BY A LARGE CIRCULAR HOLE
P. Z. Lugovoi Aug. 1971 11 p refs Transl. into ENGLISH from Prik. Mekhan. (USSR), v. 7, no. 5 p 116-120
(NAL-TR-91) Avail: NTIS HC $3.00

The torsion of a conical shell weakened by a large hole, sufficiently far away from the apex of the cone was investigated using a previously developed method. The basic stress was considered to be known, and the contour of the hole was free. A mathematical solution is developed. Author

N74-15622# National Aeronautical Lab., Bangalore (India).
INVESTIGATION OF STABILITY OF A SHELL BY THE METHOD OF FINITE DIFFERENCE
V. V. Kabonov Mar. 1972 17 p ref Transl. into ENGLISH from Tr. Vses. Sezda Teor. Prikl. Mekh. (Moscow), no. 1, 1971 p 24-29
(NAL-TR-120) Avail: NTIS HC $3.00

The algorithm study of the stability of circular cylindrical shells by finite difference method is presented. The initial state of the shell is momentarily axisymmetric. A system of Donnel type of equations, useful for the study of a shell of arbitrary length has been used. The system of algebraic equations was solved by Ganss's method of eliminations in matrix form. A program was constituted to investigate the problem of stability of the shell under different loads and arbitrary boundary conditions. As a supplement to the algorithm, the stability of a shell under the action of external pressure and heating was considered. Author

N74-15623# National Research Council of Canada, Ottawa (Ontario).
BUCKLING OF A PLATE UNDER A UNIFORM LINE LOAD ON ONE SIDE
K. Kloeppel and C.-H. Wagemann 1973 17 p refs Transl. into ENGLISH from Der Stahlbau (West Germany), v. 33, no. 7, 1964
(NRC-TT-1712) Avail: NTIS HC $3.00

Buckling coefficients are discussed for a nonstiffened plate supported according to Navier boundary conditions under a constant boundary load. It is shown that when a plate is subjected to single loads, which act on a load distributing flange, the flange may be regarded as an elastically supported beam. Formulae for determining the distribution of the reaction forces are presented. F.O.S.

N74-15624# National Research Council of Canada, Ottawa (Ontario).
APPRAISAL OF THE BUCKLING STRENGTH OF TRANSVERSELY LOADED WEB PLATES
W. Warkenthin 1973 11 p refs Transl. into ENGLISH from Der Stahlbau (West Germany), v. 34, no. 1, 1965 p 28-29
(NRC-TT-1713) Avail: NTIS HC $3.00

The buckling strength of transversely loaded web plates is analyzed. The problem studied considers an ideal flat web plate with sides a and b and thickness t, subject to longitudinal stresses theta sub x, shearing stresses tau, and a transverse load P applied to the top edge at the point alpha/2. This transverse load may be either a point or a line load. The given solution is restricted to the field of pure elastic buckling, and the buckling strength is found when theta sub x, tau, and P act simultaneously. The computation of buckling strength is included. K.M.M.

N74-15625*# Southwest Research Inst., San Antonio, Tex.
ASSEMBLY AND ANALYSIS OF FRAGMENTATION DATA FOR LIQUID PROPELLANT VESSELS
W. E. Baker, V. B. Parr, R. L. Bessey, and P. A. Cox Jan. 1974 236 p refs
(Contract NAS3-16009)
(NASA-CR-134538) Avail: NTIS HC $14.00 CSCL 20K

Fragmentation data was assembled and analyzed for exploding liquid propellant vessels. These data were to be retrieved from reports of tests and accidents, including measurements or estimates of blast yield, etc. A significant amount of data was retrieved from a series of tests conducted for measurement of blast and fireball effects of liquid propellant explosions (Project PYRO), a few well-documented accident reports, and a series of tests to determine auto-ignition properties of mixing liquid propellants. The data were reduced and fitted to various statistical functions. Comparisons were made with methods of prediction for blast yield, initial fragment velocities, and fragment range. Reasonably good correlation was achieved. Methods presented in the report allow prediction of fragment patterns,

given type and quantity of propellant, type of accident, and time of propellant mixing. Author

N74-15626*# Old Dominion Univ., Norfolk, Va.
FINITE ELEMENT ANALYSIS OF A COMPOSITE MATERIAL INTERFACE Final Technical Report
Kenneth H. Murray Aug. 1973 44 p refs
(Contract NAS1-9434)
(NASA-CR-132341; TR-73-C1) Avail: NTIS HC $4.25 CSCL 20K

A finite element model of a composite material interface is developed to study the influence of the interface on the thermal strain in the composite. A plane stress model is used with an axisymmetric model as a check. The interface thickness, thermal coefficient, modulus, Poisson's ratio and the percent of mineral in the composite are variables in the study. The results confirmed the usability of the finite element model in studying the polymer-mineral interface. Author

N74-15627# Lockheed Missiles and Space Co., Palo Alto, Calif.
VIBRATIONS AND STABILITY OF SHELLS OF REVOLUTION WITH DISCRETE INCLUSIONS AND HOLES
A. A. Malinin [1973] 6 p refs Transl. into ENGLISH from Prikl. Mekh. (USSR), v. 9, no. 10, 1973 p 29-34
Avail: NTIS HC $6.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A shell of revolution, reinforced by stringers and ribs, with concentrated masses at points, and with holes having free edges was investigated. The energies of tension-compression, torsion, and bending were considered in determing the strain components and displacements. The influence of static forces on the natural vibration frequencies of hinge-supported cylindrical shell with a concentrated mass was also investigated. Graphs, showing the dependence of the natural vibration frequencies of a cylindrical shell with mass subjected to axial compressive and tensile forces, and the analogous dependence of natural vibration of a cylindrical shell with mass subjected to internal and external pressures are presented. F.O.S.

N74-15628# National Aerospace Lab., Tokyo (Japan).
ON THE LINEAR THEORY OF THIN ELASTIC SHELLS
Susumu Toda and Tatsuzo Koga Jul. 1973 15 p refs
(NAL-TR-330T) Avail: NTIS HC $3.00

The linear theory of thin elastic shells is discussed within the framework of Kirchhoff-Love's hypothesis. Various approximate expressions of the strain-displacement relations and the constitutive equations are derived simply neglecting the terms of the order of magnitude of the ratio of the wall-thickness to the least radius of curvature of the shell in comparison with the other terms within the equations. Identity and equivalence of these expressions with the existing ones are indicated. Four sets of the approximate expressions of the constitutive equations are presented, all of which satisfy the equilibrium equations referring to the balance of moment about the normal to the middle surface. Three of them turn out to be identical to those of the existing theories, whereas the remaining one appears to be new. For each of these constitutive equations, the equilibrium equations are written in terms of the displacement in an analogous manner of Donnell for a circular cylindrical shell. Comparison of the resulting eighth order differential equations is made by calculating eigenvalues for some particular cases of loading. The results show no appreciable difference among the solutions. Author

N74-15629# Oak Ridge Y-12 Plant, Tenn.
X-RAY DIFFRACTION RESIDUAL STRESS ANALYSIS USING HIGH PRECISION CENTROID SHIFT MEASUREMENT TECHNIQUES: APPLICATION TO URANIUM-0.75 WEIGHT PERCENT TITANIUM ALLOY
W. E. Baucum and A. M. Ammons 26 Jul. 1973 12 p refs Presented at 22d Ann. Denver Conf. on Appl. of X-ray Analysis, Denver, 22-24 Aug. 1973
(Contract W-7405-eng-26)
(Y-DA-5284; Conf-730830-1) Avail: NTIS HC $3.00

The standard three-point parabola technique has been used extensively in residual stress analysis for peak location with precision (standard deviation) of peak shift measurements in the range of 0.01 to 0.03 deg (2 theta), where theta is the diffraction angle. While this level of precision produces useful data for peaks at high diffraction angles, it becomes untenable when a material with high elastic modulus is encountered whose only suitable peak falls below approximately 140 deg 2 theta. Uranium-0.75 wt. % titanium alloy, the material of interest in this investigation, falls into this category. A technique has been developed by which diffraction-peak centroid shifts are determined with a precision of 0.002 deg of diffraction angle. The method consists of step-scanning over the peak of interest to acquire data in digital form. Author (NSA)

N74-15630# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.
ASKA PART 3,1: MATERIAL NON-LINEARITIES. LECTURE NOTES WITH EXAMPLE PROBLEMS
H. A. Balmer and J. S. Doltsinis 1972 82 p refs
(ISD-132) Avail: NTIS HC $6.25

Theoretical foundations for the initial strain approach include thermoelastic behavior, plasticity, incremental stress-strain relations, and elastoplastic formulation of plane problems. The basic iteration loop in ASKA 3-1 is discussed. The application of the computer program is shown in 8 sample problems. An exact solution of an elastic, perfectly plastic, truss is given. ESRO

N74-15631# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.
SPLINE INTERPOLATION AND AUTOMATIC GENERATION OF INITIAL GEOMETRY FOR CABLE-NET STRUCTURES
W. Knudson and D. Nagy 1973 35 p refs
(ISD-140) Avail: NTIS HC $3.75

The problem of smooth surface approximation from discrete data values is discussed. For interpolation requirements of the cable net generation problem, a method of polar coordinate smoothing spline functios was developed. A method of automatic equal mesh generation was also developed based on a Newton iterative solution of certain nonlinear geometric relations. This method produces complete specification of the cable grid node locations and cable segments, including the irregular length grid elements which intersect the edge cables of the net. Three examples are presented to illustrate how the mesh generation procedure couples with the surface interpolation procedure to produce a satisfactory complete initial geometry specification. Author (ESRO)

N74-15632# Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia). Div. of Building Research.
EFFECT OF SIZE ON THE STRENGTH OF STRUCTURES
R. H. Leicester 1973 17 p refs
(PB-223202/3; ISBN-0-643-00073-9; Tech-Paper-71) Avail: NTIS HC $3.00 CSCL 13M

The nominal stress at failure of a structure and its structural member frequently depends on its size. Reasons for this include the effects of material heterogeneity, the presence of sharp notches, and the fabrication of material interfaces. These effects are discussed and where possible quantified in terms of current structural theory and available test information. A particularly dangerous aspect noted of the size effect is that it may not occur unless member sizes are sufficiently large and consequently may not appear in scaled-down laboratory testing. Author (GRA)

N74-15633# Hydrospace-Challenger, Inc., Rockville, Md.
THE CONFIGURATION AND LOADING OF A TORSIONALLY ELASTIC FAIRED CABLE Final Report
David B. Dillon Oct. 1973 60 p refs
(Contract N00014-70-C-0040; NR Proj. 184-476)
(AD-768319; HCI-TR-4557-0001) Avail: NTIS CSCL 13/3

A mathematical model for the equilibrium configuration and tension for a flexible, faired cable with torsional elasticity in a uniform stream is presented. The differential equations are derived and a numerical integrating program for solving the initial value problem thus posed is given in the BASIC computer language. A sample problem is solved and discussed. Author (GRA)

N74-15634# Texas Univ., Austin. Center for Highway Research.
A DISCRETE-ELEMENT METHOD FOR TRANSVERSE

VIBRATIONS OF BEAM COLUMNS RESTING ON LINEARLY ELASTIC OR INELASTIC SUPPORTS Interim Report
Jack Hsaio-ChiehChan and Hudson Matlock Jun. 1972 223 p refs Sponsored by Tex. Highway Dept. and Fed. Highway Admin.
(PB-223440/9GA; Rept-56-24) Avail: NTIS HC $18.25 CSCL 13B

A discrete element method of analysis for transverse vibration of beam columns resting on linearly or nonlinearly-elastic, or nonlinearly-inelastic, supports is presented. The applied forces include static fixed loads and time dependent dynamic loads. The program is an extension of programs BMCOL 43 to cover inelastic supports and time dependent axial thrusts. Two multielement models are used to simulate the inelastic characteristics of supports, one which allows the beam to lift off the support when it deflects, upward or downward, and the other which considers the resistance to either upward or downward deflection. An internal damping factor, which is related to the first derivative with respect to time of the curvature of the beam was included. Author (GRA)

N74-15635# Watervliet Arsenal, N.Y.
A RELATIVE OPTIMIZATION OF CANTILEVER EULER BEAMS WITH EXAMPLE FOR HAUGER'S PROBLEM
Charles R. Thomas Aug. 1973 52 p refs
(DA Proj. 1T0-61101-A-91A)
(AD-768087; R-WV-T-6-26-73) Avail: NTIS CSCL 20/11

A relative optimization of a generalized non-dimensional form of the cantilevered Euler beam is accomplished by the application of an adjoint variational principle in conjunction with a generalized Ritz procedure. Considerable weight reductions are shown to be possible within the bounds of imposed constraints for a two term Ritz approximation of Hauger's problem.
Author (GRA)

N74-15636# Newark Coll. of Engineering, N.J. Dept. of Mechanical Engineering.
EXTENDED STRUCTURAL SYNTHESIS CAPABILITY FOR AUTOMATED DESIGN OF FRAME-STIFFENED, SUBMERSIBLE, CIRCULAR, CYLINDRICAL SHELLS
Michael Pappas and Arnold Allentuch Jun. 1973 96 p refs
(Contract N00014-71-A-0124-0002)
(AD-768021; NCE-NV-8) Avail: NTIS CSCL 13/13

The report presents a procedure and computer program for the minimum weight design of circular, cylindrical, T frame (ring) reinforced, submersible shells where all metal thicknesses may be confined to specified gage thickness values. Using the designer specified parameters defining shell radius, shell length, eccentricity, operating depth, design factors of safety, construction materials properties, and, when used, the specified gage thickness values, the program will generate those values of skin thickness, stiffener web and flange thicknesses, stiffener web depth and flange width, and if desired, stiffner spacing that will produce the smallest shell weight to liquid weight displaced ratio. Design equations control general, shell (skin) and stiffener instability, and skin and stiffener yielding. (Modified author abstract) GRA

N74-15637# Arizona Univ., Tucson. Dept. of Aerospace and Mechanical Engineering.
A GRAPHICS ORIENTED INTERACTIVE FINITE ELEMENT TIME SHARING PACKAGE (GIFTS)
H. A. Kamel and M. W. McCabe 25 Jul. 1973 74 p refs
(Contract N00014-67-A-0209-0016; NR Proj. 064-531)
(AD-767330) Avail: NTIS CSCL 09/2

The report describes a general purpose analysis package (GIFTS) (Graphics oriented Integrated Finite element Time Sharing package) aimed primarily at ship structure design using the finite element method on a time-sharing system. Although the project was started with ship structures in mind, the concept has developed in such a manner as to offer a solution to other problems related to finite element analysis. The end product should provide a nationwide communication system between users enabling them to exchange data, results and programs with relative ease. The system acknowledges and uses some of the latest developments in computer technology, namely, time-sharing, inexpensive graphics terminals, and computer networks. It also may be used advantageously with mini-computers. GRA

N74-15638# California Univ., Los Angeles. Dept. of Mathematics.
THE AXISYMMETRIC BRANCHING BEHAVIOR OF COMPLETE SPHERICAL SHELLS
Charles G. Lange and Gregory A. Kriegsmann Oct. 1973 73 p refs
(Contract N00014-69-A-0200-54051; NR Proj. 041-144)
(AD-768904) Avail: NTIS CSCL 20/11

The purpose of the paper is to describe the axisymmetric branching behavior of complete spherical shells subjected to either external pressure or a centrally directed (dead) loading. By means of an asymptotic integration technique (based on the smallness of the ratio of the shell thickness to the shell radius) applied directly to a differential equation formulation, the authors are able to continue the solution branches from the immediate neighborhood of the branch points, where the solution has the functional form predicted by the linear buckling theory, to the region where the solution consists of either one or two dimples with the remainder of the shell remaining nearly spherical. The latter deflection states are the ones usually observed in experiments. The authors also deduce a number of results for the branching of solutions from the multiple eigenvalues. Finally, a boundary layer analysis is performed to determine the possible form of large deflection states. Author (GRA)

N74-15639# Army Foreign Science and Technology Center, Charlottesville, Va.
CREEP IN ELASTIC PLATES ON AN INCOHESIVE BASE WHICH REDUCES TO A RHEOLOGICAL MODEL UNDER VARIOUS LOADING LAWS
A. N. Suprun 2 Aug. 1973 12 p refs Transl. into ENGLISH from Issled. Teorii Uprugosti Plastichonosti (USSR), no. 56, 1970 p 135-142
(AD-768693; FSTC-HT-23-247-73) Avail: NTIS CSCL 20/11

The author discusses a method which can be used for extending known solutions of differential equations describing the bending of a plate in an elastic medium to the case of linear viscoelastic media. Author (GRA)

N74-15640# Defense Documentation Center, Alexandria, Va.
INFLATABLE, MODULAR AND OTHER PREFABRICATED STRUCTURES Report Bibliography, Mar. 1953 - Jan. 1973
Nov. 1973 109 p refs
(AD-769000; DDC-TAS-73-62) Avail: NTIS CSCL 13/13

The bibliography is comprised of 69 citations of unclassified reports dealing with inflatable, modular and prefabricated structures. Some of the topics included are: Modular Space Construction, Prefabricated Buildings, Modular Space Structures, and Prefabricated Modular Building Units. The techniques and effectiveness of inflatable structures applied in the Army and immediate and future application of modular structures to manned space missions are covered. Corporate Author/Monitoring Agency, Subject, Title, Personal Author, Contract, and Report Number Indexes are included. Author (GRA)

N74-15641# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
INTERACTION BETWEEN AXISYMMETRIC AND MULTILOBED CREEP BUCKLING OF CIRCULAR CYLINDRICAL SHELLS IN AXIAL COMPRESSION
Michel Benoit Aug. 1973 119 p refs
(Contract N00014-67-A-0112-0003; NR Proj. 064-425)
(AD-769051; SUDAAR-462; TR-26) Avail: NTIS CSCL 20/11

The present theoretical investigation studies the effect of small multilobed initial deviations from the exact shape upon the deformations and the critical time of a thin-walled circular cylindrical shell which was manufactured with initial axisymmetric deformations. To facilitate the analytical work, the actual solid wall of the shell is imagined to be replaced by an equivalent sandwich wall. The general equilibrium equations derived for shallow shells are expressed in terms of the stresses and deviations corresponding to the equivalent sandwich model. The radial displacement as well as the meridional, circumferential and membrane shear stresses are expressed by finite Fourier series for each face of the sandwich model. A closed form solution is found for the multilobed deformation rates and for the critical time as well. A numerical integration of the deformation rates

shows, for a given cylinder, that the multilobed creep buckling deformations grow much faster than the axisymmetric. (Modified author abstract) GRA

N74-15642# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
CREEP BUCKLING OF RELATIVELY THICK CIRCULAR CYLINDRICAL SHELLS COMPRESSED AXIALLY
Michel Benoit and Nicholas J. Hoff Jul. 1973 13 p refs
(Contract N00014-67-A-0003; NR Proj. 064-425)
(AD-769050; SUDAAR-461; TR-25) Avail: NTIS CSCL 20/11

Experimental results obtained with 31 nickel circular cylindrical shell specimens are evaluated in the light of the theory. The test results have already been reported in SUDAAR No. 415. The experimental creep buckling times obtained in axial compression at a temperature of 650F were found to be in reasonable agreement with the theoretical formulas. Author (GRA)

N74-15643# Army Materials and Mechanics Research Center, Watertown, Mass.
A STATISTICAL THEORY FOR PREDICTING RESPONSE OF MATERIALS THAT POSSESS A DISORDERED STRUCTURE
John J. McCoy Sep. 1973 48 p refs
(ARPA Order 2181)
(AD-768790; AMMRC-TR-73-42) Avail: NTIS CSCL 20/11

A statistical continuum is one with material properties that can be described only in probabilistic terms. Such continua are encountered in an ever increasing number of important engineering and scientific problems. Examples include the response of heterogeneous solids, the mechanics of the flow of blood, the dispersion of additives by a turbulent fluid, the scattering of waves by turbulence, by a temperature structure, etc. In this report a foundation is presented that can be used to describe all of these physically different phenomena. Emphasis is placed on the unique difficulties that present themselves to both the theoretical and the experimentalist and the progress that has been made in surmounting - or circumventing - these difficulties. The foundation is then applied to develop a statistical theory of heterogeneous linearly elastic solids. The applicability of the theory for predicting the response characteristics of a class of ceramics, a type of composite, a polycrystalline solid, etc., is discussed. The practical utility of the theory is demonstrated. Author (GRA)

N74-15644# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
CREEP BUCKLING OF FLAT PLATES
Michel Benoit and Nicholas J. Hoff Aug. 1973 35 p refs
(Contract N00014-67-A-0112-0003; NR Proj. 064-425; RR00903)
(AD-769052; SUDAAR-463; SU-TR-27) Avail: NTIS CSCL 20/11

The present study is an experimental investigation of the creep buckling behavior of simply supported flat rectangular plates. The plates are modeled in the experiments by the four faces of square prisms which are submitted to pure axial compression in a special oven at a temperature of 600F. Thirty-three square prisms built of 0.020 in. thick 2024-T3 aluminum alloy sheet were tested at various stress levels. The continuously recorded end-shortening curves led to the determination of a creep power law for the material at 600F. The ensuing comparison of the buckling time obtained from the experiments with the theory yielded fairly good results even though the experimental scatter-band was quite large. Author (GRA)

N74-15645# California Univ., Berkeley. Structural Engineering Lab.
NONLINEAR STATIC AND DYNAMIC ANALYSIS OF SHELLS OF REVOLUTION UNDER AXISYMMETRIC LOADING
Technical Report, Jun. 1972 - Sep. 1973
S. Nagarajan Sep. 1973 179 p refs
(Contracts DAAA21-72-C-0727; DAAA21-72-C-0729)
(AD-768889; UCSESM-73-11) Avail: NTIS CSCL 20/11

A method of analyzing nonlinear static and dynamic responses of deformable solids has been developed based on an incremental variational formulation using the Lagrangian mode of description. The material nonlinearity due to plasticity or viscoplasticity as well as the geometric nonlinearity due to large displacements are considered. The equations of motion are obtained in a linearized incremental form using the principle of virtual work and solved using step-by-step numerical integration procedures. Equilibrium check is made at the end of each step and the residual forces are added to the next increment for improved accuracy over the pure incremental method. For elastic-plastic solutions the flow theory of plasticity is used along with the von Mises yield condition for isotropically hardening materials. The viscoplastic constitutive theory is also in the form of an associated flow law and capable of considering strain rate sensitive behavior. The viscoplastic strains are taken into account using an initial strain formulation. The discretization of the structure is achieved by the use of degenerate isoparametric finite elements and the computer codes that have been developed are capable of analyzing large axisymmetric deformations of shells of revolution. (Modified author abstract) GRA

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N74-15646 British Library Lending Div., Boston Spa (England).
FORMATION OF EXPLOSIVE CLOUDS OF GAS ON OVERHEAD RELEASE AND PREVENTIVE MEASURES
K. Hess, W. Leuckel, and A. Stoeckel 3 Sep. 1973 22 p refs Transl. into ENGLISH from Chem.-Ing.-Tech. (West Berlin), v. 45, no. 5, Mar. 1973 p 323-329
(BLL-SMRE-Trans-6258-(8313.4)) Avail: British Library Lending Div., Boston Spa, Engl.: 3 BLL photocopy coupons

The characteristics of explosive clouds of gas which form during overhead release are discussed. The considerable influence exerted by the buoyancy on the gas/air mixing contours in the jet, and thus upon the flammable mass of gas, is demonstrated by examples of results obtained with a numerical analysis. The condition existing on release of a gas having a specific gravity greater than air is considered especially critical. It is stated that the accumulation of a large mass of flammable gas in the culmination cloud can only be avoided by ensuring that the jet released has an adequate leaving momentum. Author

N74-15647 British Library Lending Div., Boston Spa (England).
HEAT TRANSFER IN WATER DROPLETS AND ITS SIGNIFICANCE IN THE CALCULATION OF HIGHLY RATED SPRAY COOLERS
J. Nitsch 7 Jun. 1973 14 p refs Transl. into ENGLISH from Chem. Ing. Tech. (West Berlin), v. 44, no. 5, Mar. 1972 p 301-306
(BLL-WH-327-(9091.9F)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

Experiments are performed in which the rate of heating of the droplets is a direct measure of the heat transfer coefficient on the droplet side. The results are compared with measurements of other authors and integrated in a calculation model which describes the cooling of hot exhaust gases in spray coolers. Calculation results are given and measurements on pilot plants are adduced for evaluation. Author

N74-15648 British Library Lending Div., Boston Spa (England).
CALCULATION OF THERMODYNAMIC FUNCTION CHANGES OCCURRING DURING WETTING OF SOLID SURFACES BY LIQUIDS
G. A. Grigorev [1973] 7 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (USSR), v. 5, 1973 p119-122
(BLL-M-21775-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

Expressions are proposed for the calculation of the thermodynamic functions delta G, delta S, and delta H occurring on wetting of vertical solid discs by a liquid. Some representative calculations are given. Author

N74-15649 British Library Lending Div., Boston Spa (England).
STATIONARY NON-LINEAR THERMAL CONDUCTIVITY IN MULTI-LAYER FLAT WALLS
I. M. Fedotkin, A. M. Aizen, and I. S. Redchits [1973] 10 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (USSR), v. 5, 1973 p 158-161
(BLL-M-21777-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

Nonlinear stationary thermal conductivity in a multilayer flat wall was investigated. Formulas were derived for the heat flux through any layer of the wall and the heat transfer through the wall. An example of heat flow rate through a real three-layer wall is examined. Author

N74-15650 British Library Lending Div., Boston Spa (England).
THE TEMPERATURE FIELD IN A CYLINDRICAL BODY DURING ITS UPSETTING
N. Yu. Taits, V. D. Olyak, S. Z. Yubovich, and A. G. Yarosh [1973] 7 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (Moscow), v. 6, 1973 p 81-83
(BLL-M-21800-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

An analytical solution to the problem of the temperature field distribution in a cylindrical body during plastic deformation is presented. The heat exchange conditions between the end faces of the body and the tool, and between the lateral faces and the surrounding media are studied. The problem is solved using successive integral conversion of the differential equation for the thermal conductivity along the dimensionless coordinates for variable iron specimens. Author

N74-15651 British Library Lending Div., Boston Spa (England).
INVESTIGATION OF THERMAL CONDUCTIVITY WITH FUNCTIONALLY DEPENDENT PARAMETERS
Yu. S. Postolnik, V. A. Garanchuk, and V. M. Gura [1973] 18 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (Moscow), v. 6, 1973 p 140-145
(BLL-M-21795-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 7 BLL photocopy coupons

An approximate method of solving the nonlinear problem of thermal conductivity of various materials is presented. The solution takes into account the relationship of the coefficient of thermal conductivity, heat capacity, and density to temperature. Equations are given for calculating temperature fields. The effects of the variability of the coefficient of thermal conductivity, the heat capacity, and density are investigated. Author

N74-15652* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DUAL MEASUREMENT ABLATION SENSOR Patent
Charles A. Gurtler, inventor (to NASA) Issued 1 Jan. 1974 5 p Filed 11 Aug. 1971 Supersedes N72-11830 (10 -02, p 0262)
(NASA-Case-LAR-10105-1; US-Patent-3,782,181; US-Patent-Appl-SN-170680; US-Patent-Class-73-86) Avail: US Patent Office CSCL 20M

A dual measurement ablation sensor for measuring both char-interface and surface recession at a point in an ablating material is described. The sensor permits measurement of the thickness of the char layer. Char-interface recession is indicated by a drop in the resistance to a current passed through the ablation material. Surface recession is indicated by the closing of an electrical circuit when melting causes the release of a spring switch. Official Gazette of the U.S. Patent Office

N74-15653 Connecticut Univ., Storrs.
UNSTEADY HEAT TRANSFER FROM AN INFINITELY LONG CIRCULAR CYLINDER IN A LOW REYNOLDS NUMBER FLOW Ph.D. Thesis
David Michael Rose 1973 128 p
Avail: Univ. Microfilms Order No. 73-24431

A theoretical investigation is presented of the temperature distribution in a low Reynolds number flow past an infinitely long heated circular cylinder following a sudden change in the temperature of the cylinder. Solutions describing the initial development of the temperature field and the final approach to the eventual steady state are determined by solving the governing energy equation for small and for large values of time. This equation is solved by using a combination of the Laplace transform technique and the method of matched asymptotic expansions. The calculated expressions for the Nusselt number for small and for large values of time show reasonable agreement in the overlap region, and appear to give a full description of the Nusselt number for all values of time. Dissert. Abstr.

N74-15654# National Aeronautical Lab., Bangalore (India).
THERMAL STRESS OF A SHALLOW SPHERICAL SHELL
A. M. Novikova and I. A. Motovilovets Mar. 1972 17 p refs Transl. into ENGLISH from Akad. Nauk Ukr. SSR, Inst. Mekhan. Tepl. Napryazh. v Elementakh Konstrukt. (USSR), no. 9, 1970 p 23-34
(NAL-TR-113) Avail: NTIS HC $3.00

Matrix notations and Laplace transformations are used to determine the axisymmetric stressed state of nonuniformely heated shallow spherical shell. Considered is a thermoelastic temperature distribution. G.G.

N74-15655*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
SOME ENVIRONMENTAL CONSIDERATIONS RELATING TO THE INTERACTION OF THE SOLID ROCKET MOTOR EXHAUST WITH THE ATMOSPHERE: PREDICTED CHEMICAL COMPOSITION OF EXHAUST SPECIES AND PREDICTED CONDITIONS FOR THE FORMATION OF HCl AEROSOL
Robert A. Rhein 1 Dec. 1973 24 p refs
(Contract NAS7-100)
(NASA-CR-136558; JPL-TM-33-659) Avail: NTIS HC $3.25 CSCL 21H

The exhaust products of a solid rocket motor using as propellant 14% binder, 16% aluminum, and 70% (wt) ammonium perchlorate consist of hydrogen chloride, water, alumina, and other compounds. The equilibrium and some frozen compositions of the chemical species upon interaction with the atmosphere were computed. The conditions under which hydrogen chloride interacts with the water vapor in humid air to form an aerosol containing hydrochloric acid were computed for various weight ratios of air/exhaust products. These computations were also performed for the case of a combined SRM and hydrogen-oxygen rocket engine. Regimes of temperature and relative humidity where this aerosol is expected were identified. Within these regimes, the concentration of HCL in the aerosol and weight fraction of aerosol to gas phase were plotted. Hydrochloric acid aerosol formation was found to be particularly likely in cool humid weather. Author

N74-15656*# AiResearch Mfg. Co., Los Angeles, Calif.
BRAYTON HEAT EXCHANGER UNIT DEVELOPMENT PROGRAM (ALTERNATE DESIGN) Final Design Report,
J. D. Duncan, J. C. Gibson, R. F. Graves, C. J. Morse, and C. E. Richard 2 Aug. 1973 94 p
(Contract NAS3-13454)
(NASA-CR-121269; AiResearch-73-9461) Avail: NTIS HC $6.75 CSCL 20M

A Brayton Heat Exchanger Unit Alternate Design (BHXU-Alternate) consisting of a recuperator, a heat sink heat exchanger, and a gas ducting system, was designed and fabricated. The design was formulated to provide a high performance unit suitable for use in a long-life Brayton-cycle powerplant. Emphasis was on double containment against external leakage and leakage of the organic coolant into the gas stream. A parametric analysis and design study was performed to establish the optimum component configurations to achieve low weight and size and high reliability, while meeting the requirements of high effectiveness and low pressure drop. Layout studies and detailed mechanical and structural design were performed to obtain a flight-type packaging arrangement, including the close-coupled

integration of the BHXU-Alternate with the Brayton Rotating Unit (BRU). Author

N74-15657*# North Carolina State Univ., Raleigh.
THERMODYNAMIC PROPERTIES OF UF6 AT HIGH TEMPERATURES
H. A. Hassan and Jerry E. Deese Washington NASA Jan. 1974 36 p refs
(Grant NGR-34-002-177)
(NASA-CR-2373) Avail: NTIS HC $3.00 CSCL 20M

The equilibrium composition and the thermodynamic properties of the mixture resulting from the decomposition of uranium hexafluoride is calculated for temperatures ranging from 600 K to 4000 K at pressures from 0.01 atmospheres to 10 atmospheres. Author

N74-15658*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FILM COOLING IN A COMBUSTOR OPERATING AT FUEL-RICH EXIT CONDITIONS
Robert R. Tacina and Cecil J. Marek Washington Jan. 1974 35 p refs
(NASA-TN-D-7513; E-7561) Avail: NTIS HC $3.00 CSCL 20M

Data were taken with a film-cooled test plate placed in the exhaust stream of a rectangular combustor. Results showed that in a fuel-rich zone, fuel entrained into the film-cooling air would burn at the conditions tested. Test conditions were cooling-gas flow rates, 9.5 and 5 percent of total gas flow; cooling-gas velocities, 23 and 12 m/sec; ambient-temperature cooling gas; hot-gas velocity, nominally 215 m/sec; fuel-air ratio to stoichiometric fuel-air ratio values of 0.1, 0.8, 1.0, 1.2, and 1.35, resulting in hot-gas temperatures from 590 to 2100 K; and atmospheric pressure. Analytical prediction of wall temperatures agreed reasonably well with experimental results. Author

N74-15659*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF INCREASED FUEL TEMPERATURE ON EMISSIONS OF OXIDES OF NITROGEN FROM A GAS TURBINE COMBUSTOR BURNING ASTM JET-A FUEL
Nicholas R. Marchionna Washington Jan. 1974 18 p refs
(NASA-TM-X-2931; E-7634) Avail: NTIS HC $2.75 CSCL 20M

An annular gas turbine combustor was tested with heated ASTM Jet-A fuel to determine the effect of increased fuel temperature on the formation of oxides of nitrogen. Fuel temperature ranged from ambient to 700 K. The NOx emission index increased at a rate of 6 percent per 100 K increase in fuel temperature. Author

N74-15660*# General Dynamics/Convair, San Diego, Calif. Aerospace Div.
EVALUATION OF COATED COLUMBIUM ALLOY HEAT SHIELDS FOR SPACE SHUTTLE THERMAL PROTECTION SYSTEM APPLICATION. VOLUME 2, PHASE 2: SUBSIZE HEAT SHIELD AND SMALL SIZE TPS EVALUATION Report for Feb. 1971 - Jul. 1973
W. E. Black Aug. 1973 540 p refs
(Contract NAS1-9793)
(NASA-CR-112119-2) Avail: NTIS HC $29.00 CSCL 22B

Initially a trade study was conducted of seven heat shield configurations. These were evaluated for structural reliability, fabricability, weight, inspectability, and refurbishability. Two concepts, a tee-stiffened and an open corrugation, were selected as offering the most potential for system success. Fourteen subsize heat shields of a full scale section were fabricated from C-129Y and Cb-752 and silicide coated with R-512E. These subsize panels were subjected to a simulated flight profile representing temperature, local surface pressures, and applied pressure differential loads. All corrugated panels of both alloys sustained 100 cycles without structural or coating failure. All Cb-752/R-512E panels performed well with one panel being successfully repaired after 66 cycles and completing 100 cycles. As a result of this evaluating the Cb-752/R-512E system was selected for hardware application during the subsequent phases. In addition, the tee-stiffened configuration was selected for further development and application in Phase III. This selection was based on an overall assessment of relative weight, cost, and structural performance of the tee-stiffened and open corrugation TPS. Author

N74-15661# Interior Dept., Washington, D.C.
ASSESSMENT OF GEOTHERMAL ENERGY RESOURCES
Dallas L. Peck 25 Sep. 1972 86 p refs
Avail: NTIS HC $6.50 CSCL 20M

A study was conducted to develop and assessment of the state of the art and to recommend a research program to provide the basis for establishing the proper role of geothermal resources. It is expected that geothermal resources can accomplish the following: (1) provide additional energy to alleviate the Nation's impending storage, (2) water to supplement present supplies, and (3) mineral resources. It was recommended that an expanded program be conducted to assess the magnitude, type, and location of the Nation's geothermal resources and to spur the development of improved technology for discovering, evaluating, and utilizing the resources. The significant accomplishments to be realized by such a program are defined. Author

N74-15662*# Kanner (Leo) Associates, Redwood City, Calif.
BASIC EXPERIMENTS IN TEMPERATURE REGULATION
J. Aschoff Washington NASA Jan. 1974 14 p refs Transl. into ENGLISH from Arch. Ges. Physiol. (Berlin), v. 247, 1944 p 470-479
(Contract NASw-2481)
(NASA-TT-F-15226) Avail: NTIS HC $3.00 CSCL 20M

A method is described by which characteristic values which permit a numerical comparison between various heat transmission conditions can be obtained from the cooling curves for a body in a flow calorimeter. The cooling values are calculated as the slope of a straight line which is obtained from a logarithmic plot of the measured caloric values versus time. These cooling values can be used to compare different heat transmission conditions for various bodies with one another in the cooling experiment, involving a flow calorimeter into which a hand, or a model of a hand, can be immersed. The inlet and outlet water temperatures are taken by means of thermocouple elements and are plotted with a continuous recorder. Author

N74-15663# RAND Corp., Santa Monica, Calif.
EFFECTS OF STRONG EXPLOSIONS. 6: SOVIET LITERATURE TRANSLATIONS
Simon Kassel, comp. Dec. 1972 127 p refs
(Contract DAHC15-73-C-0181; ARPA Order 189-1)
(AD-767662; R-760/5-ARPA) Avail: NTIS CSCL 18/3

The effects of strong explosions, particularly nuclear explosions, and their simulation under laboratory and field conditions involve a very broad range of phenomena and parameters such as high temperatures, pressures, electromagnetic energy densities, interaction of energy with materials, shock waves in gases, liquids, and solids, and, in general, events occurring under conditions of a high degree of mechanical, thermal, and radiation stress. The series of Rand Reports of which this is the sixth to be published covers a variety of the pertinent topics as they are reflected in the currently available Soviet literature, by supplying abstracts from and summaries of the scientific and technological publications of the U.S.S.R. Topics discussed include: Shock waves, and explosions in gases; shock waves in solids; shock waves in liquids; interaction of shock waves with solids; high-speed flow past bodies; reentry shielding; atmospheric physics; laser simulation and related effects; exploding wires; electrical discharges; plasma dynamics; equations of state; properties of composite materials; and, soil mechanics. GRA

N74-15664# Naval Ammunition Depot, Crane, Ind.
THEORETICAL LIGHT YIELDS FROM DIFFERENT ILLUMINATING FLARE COMPOSITIONS
Henry A. Webster, III, John E. Tanner, Jr., and Bernard E. Douda 20 Jul. 1973 17 p refs
(AD-767928; NAD-CR-RDTR-253) Avail: NTIS CSCL 19/1

In an effort to predict improvements in the light output of magnesium-sodium nitrate-binder flare systems and to predict the success of other fuel-oxidizer flare systems, a semi-quantitative model is derived which relates the intensity of visible light emission from a flare to various thermodynamic properties of the combustion reactions which occur. After taking into account various energy

losses, the amount of light emitted is determined. Calculations are done using sodium nitrate and sodium perchlorate as oxidizers and various metals, e.g., aluminum, magnesium, beryllium, and silicon as fuels. (Modified author abstract) GRA

N74-15665# Harry Diamond Labs., Washington, D.C.
A GUIDE FOR SELECTING HIGH-VALUE CAPACITORS FOR FUZE APPLICATIONS
Henry W. Gilliand Jun. 1973 14 p refs
(DA Proj. 1W2-62301-A-300)
(AD-768707; HDL-TM-73-12) Avail: NTIS CSCL 19/1

Guidelines were established to facilitate the selection of high-value capacitors for ordnance fuzing and other military applications. Background information has been compiled on the electrical and physical properties of ceramic capacitors rated to 10 microfarads and electrolytic capacitors rated in thousands of microfarads, either of which is also available in ratings below one microfarad. Standard dc working voltages range from 25 to 1000 volts for the ceramics and from 6 to 600 volts for the electrolytics. Since the report is concerned primarily with fuzing applications, only the high-K ceramic and tantalum dielectric capacitors are discussed in any detail. The high-voltage ceramics and aluminum electrolytics are included mainly for comparison.
Author (GRA)

N74-15666# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
COMBUSTION GENERATED NOISE IN TURBOPROPULSION SYSTEMS Interim Technical Report
B. N. Shivashankara, J. C. Handley, and W. C. Strahle 24 Jul. 1973 97 p refs
(Grant AF-AFOSR-2365-72; AF Proj. 9711)
(AD-768615; AFOSR-73-1899TR) Avail: NTIS CSCL 21/2

Experiments on noise radiation by open turbulent premixed flames are described. Detailed directionality distributions, scaling rules for acoustic power radiated, thermo-acoustic efficiency and spectral content are presented and discussed. Scaling rules for reacting volume are generated by a direct flame photography technique. These experiments are shown to be quite useful in decomposing combustion noise scaling laws. The acoustic power is shown to scale as U(2.7) D(2.8) SL(1.4) F(0.4), and combustion noise spectra peak in the 250-700 Hz range. The directionality is quite weak for noise from open turbulent flames. The experimental results are critically examined in the light of the theoretical predictions from Strahle's theory of combustion noise. Author (GRA)

34 GENERAL

Includes information of a broad nature related to industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

N74-15667 California Inst. of Tech., Pasadena. Environmental Quality Lab.
TIME FACTORS IN SLOWING DOWN THE RATE OF GROWTH OF DEMAND FOR PRIMARY ENERGY IN THE UNITED STATES
Lester Lees and Mingin Philip Lo 1 Jun. 1973 35 p refs
(Grant NSF GI-29726)
(EQL-7) Copyright. Avail: Issuing Activity

The time scales involved in slowing down the rate of growth of primary energy consumption in the U.S., as one component of an overall energy/environment strategy designed to limit the required volume of energy imports from overseas are discussed. Two important energy-consuming sectors of the economy are chosen as illustrative examples: (1) the automobile as a total system (25%); (2) space heating, air conditioning and water heating in the residential sector (22%). These two components of an energy-conserving policy taken together would bring the growth rate in U.S. primary energy demand down from its present rate of 4.2% per year to about 2.8% per year by 1985. Reductions in the annual growth rate of the remaining 50% of U.S. primary energy consumption that seem quite feasible would bring the overall growth rate down to about 2.5% per year by 1985. If reductions in growth rate of this magnitude could in fact be achieved, energy imports would peak in the mid-1980s at a level no higher than about 60% above the present (1973) volume of imports. Incentives and disincentives designed to bring about this slowdown in the rate of U.S. energy consumption are discussed. Author

N74-15668 Harvard Univ., Cambridge, Mass.
USING ANALYSIS EFFECTIVELY IN A COMPLEX DECISION PROCESS PLANNING NASA'S PLANETARY PROGRAMS Ph.D. Thesis
James Addison Walker 1973 310 p
Avail: Univ. Microfilms Order No. 73-27546

Some problems of applying systems analysis techniques to major policy problems imbedded in complex decision processes are illustrated by case studies of attempts to apply such techniques to long range planning for NASA's unmanned planetary exploration program. It is found that most of the analytic efforts adopted relatively formal methodologies and concentrated on analysis of scientific, technological and economic issues of planetary program planning. Such efforts were found to have had little or no impact on policy outcomes, nor have they had much success in gaining acceptance by NASA planners for the analytic techniques used. These cases are compared with planning efforts directed by NASA's Planetary Programs Division in the 1968 - 1970 period which did have a significant impact on policy outcomes. These latter efforts employed analytical techniques of a somewhat less formal variety, but featured careful consideration of the organizational, political and psychological aspects of the surrounding decision process. Dissert. Abstr.

N74-15669*# RAND Corp., Santa Monica, Calif.
TRANSPORT IMPROVEMENT, COMMUTING COSTS, AND RESIDENTIAL LOCATION
James P. Stucker May 1973 33 p refs
(P-4983) Avail: NTIS HC $3.75

A theoretical framework for evaluating the effects of introducing new transportation on residential travel patterns is presented. Data are based on changes in residential location of urban commuters that alter the mode and length of work trips as well as economic factors. E.H.W.

N74-15670# Research Inst. of National Defence, Stockholm (Sweden).
FUTURE CHOICE OF WEAPONS AND TARGETS: TECHNICAL POSSIBILITIES AND RESTRICTIONS
Lars-Erik Tammelin Nov. 1973 7 p refs
(FOA-1-B-1284-M5; ISBN-91-7056-025-0) Avail: NTIS HC $3.00

Nuclear weapons play an outstanding role in modern strategic thinking. The use of conventional weapons is, however, unavoidable in almost every conceivable future war. The utilization to the extreme of the limited margin of action which does not provoke nuclear war is a likely perspective. An attempt is made to cover in brief terms a possible future development of weapons and their use, and to discuss which restrictions of a paratechnical nature this development may be subject to. Author

N74-15671*# Drexel Univ., Philadelphia, Pa. Center for the Study of Environment.
RESEARCH AND EDUCATION IN MANAGEMENT OF LARGE-SCALE TECHNICAL PROGRAMS Final Report
W. W. Hagerty, E. S. Golden, A. J. Pennington, M. Silver, H. H. Annett, G. M. Cadwell, Jr., T. A. Michael, J. A. Orlando, and S. R. Siegal 2 Jun. 1973 196 p refs
(Grant NGL-39-004-020)
(NASA-CR-136563) Avail: NTIS HC $12.00 CSCL 05A

A research effort is reported which was conducted by NASA in conjunction with Drexel University, and which was aimed at an improved understanding of large scale systems technology and management. For individual titles, see N74-15672 through N74-15678.

N74-15672* Drexel Univ., Philadelphia, Pa.
[NASA/DREXEL PROGRAM]
In its Res. and Educ. in Management of Large-Scale Tech. Programs 2 Jun. 1973 p 1-62 refs (For availability see

N74-15671 06-34)
CSCL 05A

The results are reported of the NASA/Drexel research effort which was conducted in two separate phases. The initial phase stressed exploration of the problem from the point of view of three primary research areas and the building of a multidisciplinary team. The final phase consisted of a clinical demonstration program in which the research associates consulted with the County Executive of New Castle County, Delaware, to aid in solving actual problems confronting the County Government. The three primary research areas of the initial phase are identified as technology, management science, and behavioral science. Five specific projects which made up the research effort are treated separately. A final section contains the conclusions drawn from total research effort as well as from the specific projects. D.L.G.

N74-15673* Drexel Inst. of Tech., Philadelphia, Pa.
BUILD: A COMMUNITY DEVELOPMENT SIMULATION GAME, APPENDIX A
J. A. Orlando and A. J. Pennington *In* Drexel Univ. Res. and Educ. in Management of Large-Scale Tech. Programs 2 Jun. 1973 p 63-86 Presented at the 36th Natl. Meeting, Operations Res. Soc. of Am., Miami Beach, Fla., 10-12 Nov. 1969 (For availability see N74-15671 06-34)
CSCL 05A

The computer based urban decision-making game BUILD is described. BUILD is aimed at: (1) allowing maximum expression of value positions by participants through resolution of intense, task-oriented conflicts: (2) heuristically gathering information on both the technical and social functioning of the city through feedback from participants: (3) providing community participants with access to technical expertise in urban decision making, and to expose professionals to the value positions of the community: and (4) laying the groundwork for eventual development of an actual policy making tool. A brief description of the roles, sample input/output formats, an initial scenario, and information on accessing the game through a time-sharing system are included. D.L.G.

N74-15674* Drexel Inst. of Tech., Philadelphia, Pa.
THE COMMUNITY DEVELOPMENT WORKSHOP, APPENDIX B
R. Brill (Node Four Associates, Inc.), E. Gastro (Node Four Associates, Inc.), and A. J. Pennington *In* Drexel Univ. Res. and Educ. in Management of Large-Scale Tech. Programs 2 Jun. 1973 p 87-97 Presented at the Ann. Meeting of the Environ. Design Res. Assoc., Chapel Hill, N. C., 8-11 Jun. 1969 (For availability see N74-15671 06-34)
CSCL 05A

The Community Development Workshop is the name given to a collection of techniques designed to implement participation in the planning process. It is an electric approach, making use of current work in the psychology of groups, mathematical modeling and systems analysis, simulation gaming, and other techniques. An outline is presented for a session of the workshop which indicates some of the psychological techniques employed, i.e. confrontation, synectics, and encounter micro-labs. D.L.G.

N74-15675* Drexel Univ., Philadelphia, Pa.
NASA MANAGEMENT TECHNOLOGY, APPENDIX C
G. Mason Cadwell, Jr. *In its* Res. and Educ. in Management of Large-Scale Tech. Programs 2 Jun. 1973 p 98-114 refs (For availability see N74-15671 06-34)
CSCL 05A

The relevant literature is summarized, and management technology is identified which prior research efforts have specified as applicable to other endeavors. Published research categorizes NASA contributions in the theory and practice of management by their experience in evolving and innovating advanced methods of: (1) conceiving, (2) planning, (3) administering, and (4) evaluating large-scale enterprises. Each of these categories is described, defined, and summarized. D.L.G.

N74-15676* Drexel Univ., Philadelphia, Pa.
THE NASA PLANNING PROCESS, APPENDIX D
H. A. Annett *In its* Res. and Educ. in Management of Large-Scale Tech. Programs 2 Jun. 1973 p 115-127 refs (For availability see N74-15671 06-34)
CSCL 05A

The planning process is outlined which NASA used in making some fundamental post Apollo decisions concerning the reuseable space shuttle and the orbiting laboratory. It is suggested that the basic elements and principles of the process, when combined, form a useful planning approach for solving urban problems. These elements and principles are defined along with the basic strengths of the planning model. D.L.G.

N74-15677* Drexel Inst. of Tech., Philadelphia, Pa.
PUBLIC ATTITUDES TOWARD PROGRAMS OF LARGE-SCALE TECHNOLOGICAL CHANGES: SOME REFLECTIONS AND POLICY PRESCRIPTIONS, APPENDIX E
Arthur B. Shostak *In* Drexel Univ. Res. and Educ. in Management of Large-Scale Tech. Programs 2 Jun. 1973 p 128-139 refs (For availability see N74-15671 06-34)
CSCL 05A

The question of how ready the public is for the implementation of large-scale programs of technological change is considered. Four vital aspects of the issue are discussed which include: (1) the ways in which the public mis-perceives the change process, (2) the ways in which recent history impacts on public attitudes, (3) the ways in which the public divides among itself, and (4) the fundamentals of public attitudes towards change. It is concluded that nothing is so critical in the 1970's to securing public approval for large-scale planned change projects as is securing the approval by change-agents of the public. D.L.G.

N74-15678* Drexel Inst. of Tech., Philadelphia, Pa.
URBAN SIMULATION AND GAMING: PRELIMINARY EXPERIENCE AND PERSPECTIVES, APPENDIX F
Arthur B. Shostak *In* Drexel Univ. Res. and Educ. in Management of Large-Scale Tech. Programs 2 Jun. 1973 p 140-154 refs (For availability see N74-15671 06-34)
CSCL 05A

A three-month summer study of gaming, as applied to urban problems, was conducted. The results of the study are presented along with a series of recommendations aimed at guiding the warranted efforts of others to further explore the application of scientific gaming to the solution of some of America's urban problems. Three main topics are considered and are discussed in depth. These include: (1) gaming and urbanology, (2) methodology and lessons, and (3) reforms in the Cities Game. D.L.G.

N74-15679# Commission of the European Communities, Brussels (Belgium).
THE ENERGY SITUATION IN THE COMMUNITY, SITUATION 1972, FORECASTS 1973
9 Feb. 1973 55 p
Avail: NTIS HC $4.75

An analysis of the world energy situation in 1972 and the outlook for 1973 are presented. The development of an energy policy which would improve the quality of information available concerning energy requirements and problems is discussed. The market situation in 1972 and its consequences are examined for the specific cases of petroleum, coal, gas, electricity, and nuclear energy. Tables, charts, and graphs are included to show consumption rates and predicted consumption of the significant natural resources used for energy conversion. Author

N74-15680# Committee on Science and Astronautics (U. S. House).
INDIVIDUAL ACTION FOR ENERGY CONSERVATION
Washington GPO Jun. 1973 8 p Presented to Comm. on Sci. and Astronaut., 93d Congr., 1 st Sess., 31 May 1973
Avail: Subcomm. on Energy

Prompted by a concern for conserving the limited energy supplies, suggestions are given for saving money and using less energy. Ideas are presented for: driving and purchasing automobiles; cooling and heating residential homes; using home appliances; and vacationing. K.M.M.

N74-15681# National Economic Research Associates, Inc., New York.
ENERGY CONSUMPTION AND GROSS NATIONAL PRODUCT IN THE UNITED STATES: AN EXAMINATION OF A RECENT CHANGE IN THE RELATIONSHIP

1971 29 p refs
Copyright. Avail: NTIS HC $3.50

The ratio of aggregate energy consumption to Gross National Product (the energy/GNP ratio) underwent a long-term secular decline during the period 1947-1966, following a trend that began in the 1920s. Since 1966, however, the trend has reversed and the ratio has shown an uninterrupted increase. If the trend prior to 1966 had persisted, energy consumption in 1970 would have been lower by an amount greater than the total electric utility consumption of coal in that year. An analysis of the possible reasons for this trend reversal indicates that it cannot be ascribed to any single cause but that a major part of it is apparently the result of: (1) the increasing relative importance of nonenergy uses of the fuels, (2) a tapering off in the year-to-year improvement in thermal efficiency at central power stations, and (3) the increasing relative importance of air conditioning and electric heating. The net result of these factors is a tendency toward a sustained high growth rate in aggregate energy consumption and a consequent increase in the energy/GNP ratio except in years of high GNP growth rate. Author

N74-15682# Committee on Government Operations (U. S. House).
CONSERVATION AND EFFICIENT USE OF ENERGY, PART 1
Washington GPO 1973 469 p refs Hearings before Comm. on Govt. Operations and Comm. on Sci. and Astronaut., 93d Congr., 1st Sess., No. 14, 19 Jun. 1973 Prepared in cooperation with Comm. on Sci. and Astronaut.
Avail: SOD HC $3.05

A Congressional hearing on the conservation and efficient use of energy resources is presented. The organization and functions of the Office of Energy Conservation are described. Current research and development projects being conducted by the government to conserve energy resources by increasing the efficiency of converting heat energy to electricity are explained. Improvements and developments in surface transportation systems for increased efficiency are reported. Specific research and development projects are defined to show the scope of the effort, the FY 1973 funding, and the proposed FY 1974 funding. P.N.F.

N74-15683*# National Association of Schools of Public Affairs and Administration, Washington D.C.
SCIENCE LEADERSHIP FOR TOMORROW: THE ROLE OF SCHOOLS OF PUBLIC AFFAIRS AND UNIVERSITIES IN MEETING NEEDS OF PUBLIC SCIENCE AGENCIES
Albert H. Rosenthal (New Mex. Univ.), Robert F. Wilcox (Colo. Univ.), Frank Marini (San Diego State Univ.), and H. Clyde Reeves (Council of State Govt.) Nov. 1973 46 p refs Sponsored by NSF
(Grant NGL-32-004-042)
(NASA-CR-136589; LC-73-90891) Avail: NTIS HC $4.50 CSCL 05A

Recommendations and requirements for the preparation of personnel with some scientific or technological background to enter fields of public policy and administration are reported. University efforts to provide science administration graduate programs are outlined and increased cooperation between government and university resources is outlined. G.G.

N74-15684# Committee on Interior and Insular Affairs (U. S. Senate).
FACTORS AFFECTING THE USE OF COAL IN PRESENT AND FUTURE ENERGY MAKERS
Washington GPO 1973 46 p refs Presented to Comm. on Interior and Insular Affairs, 93d Congr., 1st Sess., 1973 Prepared by Library of Congr.
Avail: Comm. on Interior and Insular Affairs

A bakground paper to inform members of Congress on the factors affecting the use of coal in present and future energy markets is presented. The subjects discussed are: (1) coal reserves, (3) mining regulations, (4) air pollution control for coal burning utilities, and (5) the policy issues which must be considered in the Federal government for adequate exploitation of coal supplies. Tables are included to show yearly consumption, forecasts of 1980 demand, potential domestic supply available, and coal characteristis by states. P.N.F.

N74-15685# Geological Survey, Washington, D.C.
ENERGY RESOURCES OF THE UNITED STATES
P. K. Theobald, S. P. Schweinfurth, and D. C. Duncan 1972 30 p refs
(CIRC-650) Avail: NTIS MF $1.45; USGS HC no charge

The accompanying diagrams present the U.S. Geological Survey estimates of the United States resources of coal, petroleum liquids, natural gas, uranium, geothermal energy, and oil from oil shale. The estimates have been complied by a group of specialists familiar with each of the energy sources, each using techniques he considers most useful for estimating his particular energy source. The short text accompanying each diagram outlines the method of estimation or the source of the estimate and defines the characteristics of each estimate. Where appropriate, comparisons with other estimates are also given. Resources, as used here, include all rocks and minerals (including their contained heat for geothermal sources) potentially usable by man. Author

N74-15686# Committee on Interior and Insular Affairs (U. S. Senate).
LEGISLATIVE AUTHORITY OF FEDERAL AGENCIES WITH RESPECT TO FUELS AND ENERGY: A STAFF ANALYSIS
Washington GPO 1973 240 p refs Presented to Comm. on Interior and Insular Affairs, 93d Congr., 1st Sess., 1973
Avail: SOD HC $1.65

A Congressional committee report on the authority of Federal agencies with respect to fuels and energy emergency management is presented. It is stated that more than forty Federal departments, agencies, and regulatory commissions affect energy matters. The reorganization and restructuring of these Federal energy activities is a principal concern of the Committee involved in the energy study. A staff analysis is developed to show the statutory authority of Federal agencies and the implementation of that authority in the energy field. The staff analysis is based on a questionnaire which requested the following information: (1) goals and objectives of the energy and (2) a summary of their respective roles within the overall body of Federal fuels and energy policy formulation and implementation. The term Energy Policy is define as all basic legal authority which authorized programs or policies designed to assist, to promote, to regulate, or to impose constraints on the range of alternatives which local, State, Federal, or private descision makers may consider in their effort to meet existing and future energy demands. Author

N74-15687# Committee on Interior and Insular Affairs (U. S. Senate).
THE PRESIDENT'S ENERGY MESSAGE AND S. 1570
Washington GPO 1973 869 p refs Hearing pursuant to S. Res. 45 before Comm. on Interior and Insular Affairs, 93d Congr., 1st Sess., 1 May 1973
Avail: Comm. on Interior and Insular Affairs

The message of the President of the United States concerning energy recources which was delivered to the Committee on Interior and Insular Affairs on 1 May, 1973 is presented. The subjects discussed are: (1) the National energy policy, (2) developing domestic energy resources, (3) importing fuels to meet demands, (4) conserving energy, (5) research and development projects for energy sources, and (6) international cooperation. The message prepared the development of legislation to authorize the President to allocate energy and fuels when he determines and declares that extraordinary shortages or dislocations in the distribution of energy and fuels exist or are imminent. The legislation provides for the delegation of authority to the Secretary of the Interior to carry out the provisions of the bill. Author

N74-15688# Committee on Interior and Insular Affairs (U. S. Senate).
SUMMARY OF THE ENERGY CONSERVATION AND DEVELOPMENT RECOMMENDATIONS CONTAINED IN THE FINAL REPORT OF THE NATIONAL COMMISSION ON MATERIALS POLICY, JUNE 1973: A BACKGROUND PAPER
Washington GPO 1973 35 p refs Presented to Comm. on Interior and Insular Affairs, 93d Congr., 1st Sess., Jun. 1973 Prepared by Library of Congr.
Avail: SOD HC $0.35 Domestic Post Paid or $0.20 GPO Bookstore

A summary of the energy conservation and development

recommendations was presented to the U.S. Congress pursuant to Senate Resolution 45. The summary was based on the final report of the National Commission on Materials Policy. The seven functions which are to be served by the national materials policy are defined. The major theme of the report is the need to strike a balance between producing goods and protecting the environment. A second theme is the need for a balance between the supply of materials and the demand for their use by increasing primary materials production. Specific recommendations are submitted for the following: (1) disposition of wastes, (2) development of energy sources, (3) land use, (4) water use, and (5) international aspects of the materials policy. The requirements for science and technology, research and development, and inventories of materials are included. P.N.F.

N74-15689# Westinghouse Electric Corp., East Pittsburgh, Pa. Fuels and Energy Systems.
THE EFFECT OF FUEL AVAILABILITY ON FUTURE R AND D PROGRAMS IN POWER GENERATION
L. G. Hauser, W. H. Comtois, and R. R. Boyle Apr. 1972 20 p refs Presented at Am. Power Conf., Chicago, 18-20 Apr. 1972
Avail: NTIS HC $3.00

An analysis of the energy requirements of various sectors of the U.S. economy is presented. Charts are developed to show trends in energy consumption and predictions of energy availability. The use of the load duration curve as a method for analyzing future electrical energy production is explained. Graphs are included to show the distribution of energy generated by capacity factor of the generating plants. Future research and development programs with emphasis on nuclear fuels and breeder reactors as a solution to the energy shortage are proposed. The creation and utilization of new methods for exploiting coal reserves are stressed. Author

N74-15690# Committee on Interior and Insular Affairs (U. S. Senate).
ENERGY CONSERVATION, PART 1
Washington GPO 1973 482 p refs Hearings pursuant to S. Res. 45 before Comm. on Interior and Insular Affairs, 93d Congr., 1st Sess., 22-23 Mar. 1973
Avail: Comm. on Interior and Insular Affairs

A Congressional hearing on the role of energy conservation in the National energy policy was conducted. The hearing assisted members of Congress and other interested parties in their understanding of the issues inherent in the formulation of a long-term National Energy Policy which assures the continued welfare of the Nation including balance growth safeguarding and enhancing the quality of the environment, and national security. The questions addressed in the hearings were directed toward: (1) the general issue of energy conservation, (2) detailed questions and policy issues, (3) requirements of the transportation sector, (4) requirements of the residential/commercial sector, (5) requirements of the industrial sector, and (6) requirements of the electric utilities. P.N.F.

N74-15691# Bureau of Mines, Bartlesville, Okla. Energy Research Center.
SELECTED LIST OF BUREAU OF MINES PUBLICATIONS ON PETROLEUM AND NATURAL GAS, 1961-1970
V. Vern Hutchinson [1972] 165 p refs Supplement to BM-IC-8240
(BM-IC-8534; BM-IC-8240-Suppl) Avail: SOD HC $1.75

This selected list contains 829 entries with citations to publications related to petroleum and natural gas, which were released during the 1961-1970 period. Some entries are multiple in nature, resulting in a total of 881 citations. The purpose of this bibliography is to provide a selective review of publications related to petroleum and natural gas during the 1961-1970 period. The publications are grouped under broad headings as shown in the contents section. Indexes, placed at the end of the list, identify publications by author with short title, detailed subject approaches, and report numbers. As the title indicates, the publications included have, for the most part, a direct and specific relationship to petroleum and natural gas. In some selections, however, the reports included are applicable to other energy fuels as well. Author

N74-15692*# National Academy of Public Administration, Washington, D.C.
PROJECT MANAGEMENT IN NASA: THE SYSTEM AND THE MEN
Robert H. Pontious and Lewis B. Barnes NASA 1973 137 p refs
(Contract NSR-09-046-001)
(NASA-SP-324; LC-73-600068) Avail: NTIS MF $1.45; SOD HC $1.55 CSCL 05A

An analytical description of the NASA project management system is presented with emphasis on the human element. The NASA concept of project management, program managers, and the problems and strengths of the NASA system are discussed. F.O.S.

N74-15693*# Kanner (Leo) Associates, Redwood City, Calif.
WILL THERE BE A MEETING WITH OTHER INTELLIGENT BEINGS?
D. Bolshov, Lev Mironovich Gindilis, and Boris Nikolayevich Panovkin Washington NASA Jan. 1974 16 p Transl. into ENGLISH from Ogonek (Moscow), no. 42, 13 Oct. 1973 p 24-26
(Contract NASw-2481)
(NASA-TT-F-15279) Avail: NTIS HC $3.00 CSCL 05K

The question of the existence and methods of communicating with extraterrestrial civilizations are analyzed by several U.S.S.R. scientists. Author

N74-15694# Czechoslovak National Committee of COSPAR, Prague.
SPACE RESEARCH ACTIVITIES IN CZECHOSLOVAKIA IN 1972
1973 22 p refs
Avail: NTIS HC $3.25

Satellite and rocket experiments centered on solar cosmic rays studies, measurements of charged particles and radiation belts, proton whistler observations, and ionospheric propagation effects. Ground based research considered satellite tracking activities, non-gravitational perturbations of satellite orbits, solar activity forecasts, and experimental studies of solar wind interaction with storm geometric variations. The biological effects of ionizing radiation on cells and their pharmacological modifications were also examined. G.G.

N74-15695# Mitre Corp., McLean, Va.
ENERGY, RESOURCES AND THE ENVIRONMENT
Charles A. Zraket 24 Oct. 1972 38 p Revised
(M72-180-Rev-1) Avail: NTIS HC $4.00

The proceedings of eight symposia on the subject of energy resources and requirements are summarized. The subjects discussed include the following: (1) the long term energy situation, (2) the future outlook for energy and resources, (3) the international context, (4) the intermediate situation or energy crisis, (5) options for the long term situation, (6) transportation requirements, (7) current problems with the environment, and (8) long term environment impact factors. Author

N74-15696# RAND Corp., Santa Monica, Calif.
SEATTLE'S ADAPTATION TO RECESSION
R. B. Rainey, Jr., K. Anna, A. Bonner, S. Crocker, L. Day, B. Hawkins, N. King, R. A. Levine, and D. Relles Sep. 1973 58 p refs
(Grant NSF GI-29763)
(R-1352-NSF) Avail: NTIS HC $5.00

Results and implications are summarized of research on the adaptation of Seattle to the 1969-1972 massive recession caused there by cutbacks in aerospace employment, the implications for the area's future prosperity, and policy strategies for ensuring that prosperity. Other topics include: Seattle as a high-wage labor market; an economic model of the Seattle economy; individual adaptations to unemployment; and aircraft industry forecast. K.M.M.

N74-15697# Chase Manhattan Bank, New York. Energy Economics Div.
OUTLOOK FOR ENERGY IN THE UNITED STATES TO 1985
John G. Winger, Gerald D. Gunning, John D. Emerson, Richard

C. Sparling, and Arthur J. Zraly Jun. 1972 56 p
Avail: NTIS HC $5.00

The energy requirements of various sectors of the U.S. economy are analyzed. Graphs and charts are developed to show previous energy consumption levels and predictions are made for future requirements to 1985. A comparison is made for the amounts of energy in the form of oil, natural gas, coal, water, and nuclear used by various geographical areas of the United States. Tables of data are prepared to show the potential sources of energy, both foreign and domestic. The economic impact of depending on foreign sources for resources is analyzed. Author

N74-15698# RAND Corp., Santa Monica, Calif.
RESIDENTIAL ENERGY USE: AN ECONOMETRIC ANALYSIS
Kent P. Anderson Oct. 1973 89 p refs
(Grant NSF GI-44)
(R-1297-NSF) Avail: NTIS HC $6.50

The demands of the residential sector of the U.S. economy for energy resources in the form of gas and electricity are discussed. Tables of data are presented to show the various predictions concerning the future price of electricity and natural gas to the consumer. Methods for predicting the future cost of energy resources are explained. The energy requirements for residential use are expressed in mathematical models and the results are tabulated for type of fuel, type of home, and specific use within the home. Author

N74-15699# Royal Radar Establishment, Malvern (England). Ground Radar Div.
ON THE MINIMIZATION OF IDENTIFICATION RESIDUES
W. B. Bishop (US Naval Res. Lab., Washington) and P. L. Owen Mar. 1973 81 p
(RRE-TN-773; BR36385) Avail: NTIS HC $6.25

A military identification system may be required to identify unknowns that are friends, enemies, or neutrals. The analysis and design of such systems is simplified by considering separately the manner in which each type of unknown is to be identified. The unknowns that remain so after attempts to identify them are called the identification residue. It is shown that precise definitions of the basic parts of an identification system will enable a computer to determine the relative effectiveness of different methods of identifying unknowns in various situations. In general, the identification method that produces the minimum identification residue without violating prescribed rules provides the best identification system. The manner in which identification residues can be minimized is illustrated by some arbitrarily-selected numerical examples. Author (ESRO)